WORLD—Graphic Calculation of Transmission Lines and articles on operating practice.

Electrical World

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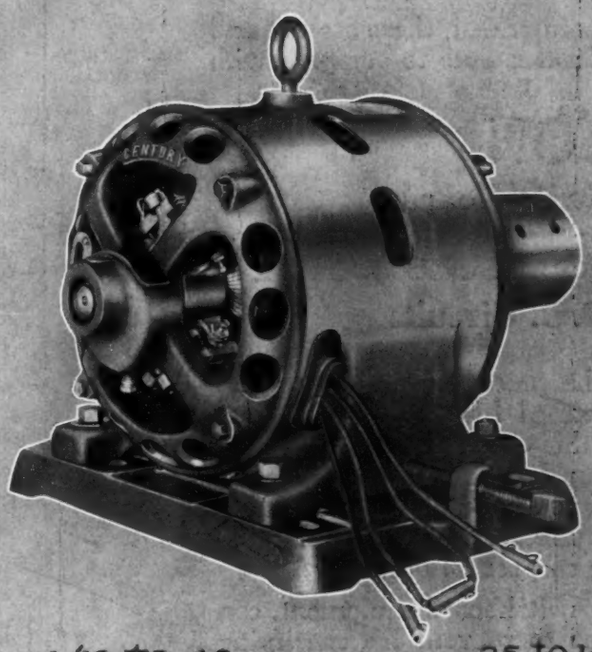

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Electrical World

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Freedom from Labor Troubles

ELECTRIC light and power utilities seldom have labor troubles to interrupt their highly necessary public service. Their position is in strong contrast to that of transportation companies, which at the present time are excessively burdened with difficulties. Fortunately for central station companies and for the industries and communities which rely upon their service, these properties, because of the nature of their physical plants, do not have to depend so largely upon organized labor as do the railways and other classes of industries. Although relying upon the loyalty of employees, they are able to look to a large extent to the efficiency of physical elements and are not harried by questions affecting labor as are the transportation lines. Another circumstance which contributes to the relative freedom of electrical utilities from labor complications is that their business is so stable that they provide regular employment for their men and generally avoid the periods of shutdown or idleness which contribute to dissatisfaction and breed discontent in other industries. Employees get a distinct benefit from the fact that only rarely is their business subject to depression, and that, on the contrary, the volume of it is usually maintained, if not increased, no matter what conditions prevail in the country at large.

Cost-Keeping the Foundation of Business

FOR two predominant characteristics in its work the Federal Trade Commission is entitled to the gratitude of businessmen: First, for arousing an interest in the vital subject of cost-keeping, and second, for the constructive policy which has its fruit in the systems of accounts just issued by the commission for the benefit of manufacturers and retail merchants. By his frequent addresses before business organizations Chairman Hurley has wisely prepared the ground for the adoption of better accounting. Associations in the electrical industry are developing accounting systems which will apply specifically the principles recommended so earnestly by the commission. The result will be that the electrical man will know definitely whether he is fooling himself on costs, as Mr. Debevoise expressed it in his article, which was published in last week's issue, and his own restraining judgment will keep him from persistence in a policy which can lead to only one end. Some of those who are in the manufacturing, jobbing, contracting and retailing parts of the industry are not directly associated with the organized efforts now under way to perfect cost-accounting. For them the systems which have been compiled by the federal commission with real solicitude for the welfare of business will be very helpful. And for all who are concerned in the maintenance of proper principles which will substitute solid fact for speculation, the pamphlets of the commission have a clear, practical value. The commission does not go to business and say bluntly: "Your accounts must conform to this system." It submits its case with the moderate statement that "a man who knows where he stands day by day is very much less likely to make a failure of his business than one who is directing his business by guesswork." If, in this time of great prosperity in the electrical industry, cost-accounting shall be recognized as absolutely essential to profit, there will be a sure foundation for the larger business of the future. And no man or institution can afford not to provide this solid foundation.

Emergency Radio Service on Shipboard

A FEW weeks ago the Department of Commerce, which controls the federal inspection of wireless telegraph stations, issued a circular letter calling attention to the need of providing spare parts for use in case of breakdown. An instance was cited in which a coastwise vessel was forced to go two and a half days without radio service because of the lack of a detector crystal for replacement. The letter from the Department of Commerce points out further that the operator was unable to improvise a detector from the materials at hand.

A condition in which the operation of a wireless telegraph outfit must be entirely suspended on account of the lack of a spare bit of carborundum is not healthy. That it can exist reflects no credit upon either the operator himself, the company which trained and employed him, or the naval examiners who granted his license certificate. This is quite over and above that part of the responsibility of the operating company which requires the supply of sufficient and suitable spare parts. The point concerned is the inability of the operator to construct a temporary detector of at least enough sensitiveness and reliability to keep the ship radio in operation.

It is a notable fact that the operating personnel of our merchant ships, or at least a large part of it, is constantly changing. New operators are being licensed daily; they are trained to understand the workings of modern radio apparatus, but have as a rule practically no knowledge of the older instruments which have been displaced. Their training, furthermore, is usually of the kind directed toward obvious and mechanical re-

sults of various manipulations, rather than toward the true functional performance of the several instruments in their charge. All this is unfortunate, for it leads to just such failures in emergency as that outlined by the Department of Commerce.

Had the operator, who was forced to sit idly by his dead receiver because the crystal had been stolen, known a little of what expedients were made use of in the early years of wireless telegraphy there would have been no failure to protect his ship by radio service. Two needles and a pencil, a knife-blade and a broken incandescent lamp, a piece of dry-cell carbon and an iron wire—any of these could be used as a microphonic detector which would take the place of the crystal and receive signals from 50 to 100 or more miles. Surely these simple materials were available to the stranded operator, and certainly the receiving range to be obtained by their use, even though limited, was worth striving for. The student of the literature of wireless telegraphy would never be at a loss for a simple but useful detector; the man who recognizes not only effects but also the reasons for them is needed as much in the practice of radio-telegraphy as in other fields of applied science. Wireless operators on ships should have better training; their instruction should be carried on beyond the point which permits them barely to secure a government license to hold a position.

Graphical Solutions of Transmission Line Problems

IN the work of estimating on the cost of power transmission there are certain factors which can be estimated at once, at so much per mile, with reasonable precision, when the preliminaries are settled. Thus, the costs of right-of-way, towers, insulators and erection can be approximated, by experience, with the district and the general character of the line in view. The cost of the conductor, however, depends not only upon the cost of metal at the place of erection; but also upon the electrical conditions of the problem. These include the power delivered, the distance, the percentage power loss, the power factor of the load, and the voltage of delivery. The formula employed, when the effects of distributed capacity and of pressure regulation are ignored, is a comparatively simple one; but even with the aid of a slide rule, the computation takes time, and there is always a chance of making a mistake, especially when the business man is hurling a running fire of questions at the anxious computer, and a large sum of money is involved in the solution. In such cases, a computing machine, which would have the entering data marked down on levers, and give the result on turning a soulless crank, would be a positive boon.

An ingenious substitute for the aforesaid machine, is offered in the graphical chart by T. A. Wilkinson, found elsewhere in this issue. The pencil makes a zigzag track across the diagram, pausing at the assigned mileage, voltage, energy loss, power factor, and delivered power. At the end of the journey the total required weight of copper or of aluminum is indicated, and the path of the pencil is easily checked. After a little practice the whole run can be made in less than half a minute. It is true that the result obtained may have to be revised somewhat, on account of capacity effects on long lines, especially with low power factors; but these are matters of detail which can be adjusted at leisure. The main object is to obtain a first approximation swiftly and with but little danger of making a mistake.

An interesting fact is brought out by the article; namely, that when a three-wire, three-phase line has been worked out, and the result obtained in thousands of pounds of copper, one-third more must be added if a fourth wire is added, in order to change from three-phase to a pair of two-phase circuits. The saving in copper, of one-quarter of the two-phase allowance, made by adopting the three-phase system, is thus clearly brought out.

Central Heating Service

MOST electric supply companies look on the auxiliary heating business as a burden, if they have to undertake it, and while in rare instances it proves profitable it oftener has been of very dubious value. O. M. Rau in a brief paper in a recent issue looks at the situation from the reverse side—the production of electricity as an incidental to central station heating. This is an entirely different matter, since when the supply of steam from a central plant can be made remunerative from the heating standpoint, the generating sets which serve as reducing valves from the high pressure boilers may be made, under favorable circumstances, a source of profit. We make this qualification because it seems to be the fact that combined heating and electrical plants, whichever element predominates, are successful only in proportion to the skillful adaptation of the means to the situation. If it chances that an electric central station has good customers for steam heat within easy reach where supply will not involve too heavy investment, well and good; while if a heating company is so situated that it can find an easy market for electrical energy, it may be made a valuable by-product.

The crux of the matter in either case is whether the nature and amount of the extra-territorial demand, so to speak, is such that it can be fully supplied without material loss of efficiency in the regular output or in the organization of the business. In the example before us there is a demand from the central electric system for all the energy that the heating plant can supply in the course of its normal business. Consequently the electrical by-product is a good and profitable one. The key to success in this and similar cases is in close and shrewd attention to the local conditions of fuel supply. Nothing but this can make a central heating plant successful, with or without incidental electricity. On the other side, steam heating from a plant fundamentally electrical, is profitable only upon similar conditions of minute care of costs. Neither seems to be a really natural combina-

tion, for, broadly, the locations of maximum economy for an electrically central station and for a general heating plant do not coincide. In so far as they can be made to do so a combination will work well, and modern facilities for electrical transmission help out the situation. But, speaking generally, the circumstances which are favorable to a real success are special rather than general, and the Milwaukee plant is to be congratulated both on its good fortune and its good management.

A Power Plant of Unique Design

THE power plant of the Ford Motor Company described in the current issue is remarkable not only on account of its immense size for direct-current operation but as well on account of peculiarities of general design and of details which render it unusual. In the first place it is easily, with a rating of 65,000 kw., one of the largest direct-current installations in the world. Secondly, it is remarkable in that it employs a composite gas engine and steam engine to operate its generators. The typical set consists of a 4000-kw., 250-volt, direct-current dynamo operated from the one end by a 3300-hp., two-cylinder, four-stroke-cycle gas engine, and from the other end by a tandem compound Corliss engine of similar rating. This particular combination produces certain important economies in operation and incidentally leads to some effective and highly ingenious modifications of controlling devices. The immense manufacturing plant which this station serves calls for so intricate a feeding system that the switchboard required is of extraordinary dimensions and the switching system must be safeguarded with extreme care to preserve the absolutely necessary continuity of service. Any serious interruption in any part of the motor plant would necessarily be little less than a calamity in its effect upon output.

Ordinarily a plant of such great magnitude would be of polyphase design with turbo-generators as the source of power. But in this instance the conditions were peculiar in that water for the boilers and condensers was difficult to obtain in adequate quantity. This lack of water seems to have been the determining factor in the rather extraordinary final design. It would be most interesting to know the tentative calculations which led up to the present choice of the equipment and the operating costs actually reached in gas operation thus reinforced by steam only to the amount rendered necessary by the condition of load. By using co-operating prime movers on each unit some important thermal economies are made possible. The cooling water from the gas engines, including even that for the piston rods, valve boxes and main bearings, emerging at a temperature of about 175 deg. Fahr. is used directly for the boiler feed and the factory supply of hot water. Thus a part, and no small part, of the otherwise inevitable heat loss in the engines is recouped.

But this is only a small portion of the thermal gain. The exhaust gases from the cylinders leave them at about 1100 deg. Fahr. and pass immediately to the work of superheating the steam between the high and low pressure cylinders. Thence it goes to the task of jacketing the steam cylinders, and finally, before reaching the stack, it operates an economizer in the feed-water system.

Records of the final temperature of the gases entering the stack are not given, but it is evident that the resulting saving of fuel on the steam end must be considerable. To harmonize the operation of the two prime movers some ingenious provisions are made, in particular the coupling of the ignition circuit to the circuit breakers in such wise that sudden loss of load instantly breaks the ignition circuit and actuates the gas throttle magnet to cut off the supply. Then the steam engine governor does the rest. In fact if things in any way go wrong on the gas side, the steam side automatically comes to the rescue.

The circuit breakers for the machines are fitted both for remote control by motors and for manual operation if required, the latter being arranged with mechanical interlocking, so that the equalizer, positive and negative contacts can be closed only in the correct order. There is also a complete automatic mechanism for control of the paralleling of the generators, so that no machine can possibly be put in circuit save when it is at the proper speed and voltage to take up its load safely and easily.

Some idea of the feeder system for this immense plant may be gained from the fact that fifty pairs of 1,000,000 circ. mil cable are already installed on roof racks, with room for forty additional pairs, while the weight of the feeder copper to the distribution centers rises to about 330,000 lb. As a whole the plant gives startling evidence of the magnitude to which motor drive rises in a great modern engineering works.

The Coming Issues

IN the engineering number of the ELECTRICAL WORLD for August, which appears next week, a leading article will present an account of an investigation of feeder arrangements and the disposition of copper in the Edison three-wire distribution system serving the business district of a large city. Another engineering article in this Aug. 19 number will present a study of the strength of splices in overhead copper lines. In addition to other leading articles and news features, the issue will also include the regular departments devoted to station operating practice, commercial and business policy, and wiring and illumination topics. The issue of the ELECTRICAL WORLD for Aug. 26, the fourth number of the month, will contain articles and features on commercial practice, with particular reference to the opening of the fall lighting season and including illustrated accounts of important lighting installations. The second number of ELECTRICAL MERCHANDISING, the new monthly magazine which extends to the electrical trade the editorial service of the ELECTRICAL WORLD organization, will be issued on Aug. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

FAN STOCKS EXHAUSTED BY CENTRAL WEST'S HOT SPELL

From Detroit to Omaha and from St. Paul to Kansas City Dealers Report the Biggest Fan Business in Years—Factories Rush Special Orders by Express

The phenomenal spell of hot weather which has prevailed throughout the Middle West for the last thirty days—during which temperatures of 103 and 105 deg. Fahr. were reported from cities and towns in the Mississippi Valley—resulted in an unprecedented shortage of electric fans throughout the territory in the grip of the prolonged hot wave.

There were practically no electric fans to be had in the Central West by the middle of the present week. Jobbers' and dealers' stocks from Detroit to Omaha and from St. Paul to Kansas City were either entirely gone or depleted to a state where nothing but the odds and ends of a fan stock remained. In fact, several jobbers in the Central territory declared that if they had had 2000 fans in stock on Aug. 8 they could have sold practically all of them before nightfall. In some instances fan orders not subject to cancellation were being taken by dealers. Express shipments from fan factories working on special orders were being resorted to. In other instances jobbers were flatly refusing to accept fan orders. Taken all in all, the fan business from the jobbers' viewpoint was unprecedented.

Biggest Fan Business Since 1911

The year 1916 was the first active fan year since 1911. Moreover, the present season's business exploded the previously existing belief that if fans did not move out of jobbers' stocks before July 10 the majority of them would have to be carried over to the following season. In some quarters the belief is advanced that the experience of this season's exceptional sale will tend to stapleize the fan business and make it more nearly an all-year-'round proposition, instead of simply a mid-summer rush. The people who advance this opinion say that it has been the dealers' practice to sign fan contracts in January, and then to put off ordering any fans until the hot weather is upon them. This program is, of course, expensive, since it involves telephone and telegraph orders and expensive rush shipments.

The inability of the trade to meet demands for fans this year will, it is thought, tend to discourage this last-minute ordering and shipping, and encourage earlier purchases, especially on the part of the progressive dealers who like to supply customers from stock. Increasing winter-time uses of fans for clearing frosted windows and for increasing the radiation from steam and hot-water radiators are also cited as factors which will influence this change.

This view is not shared universally, however, for there are some who do not believe that dealers can be induced to purchase fans in advance of hot weather. The belief that next year will be another active fan year for the manufacturers, at least, is prevalent throughout the territory, since all jobbers and some dealers will be laying in full fan stocks. The number of fans to be carried over by the trade this year is at an almost irreducible minimum.

Most jobbers reported that the best seller this year was the 12-in. alternating-current oscillating fan, but stated that the small low-priced units had also found increasing popular favor. Firm prices have characterized the business this year because the demand was too great to warrant any campaign with price cutting.

Reports from Leading Jobbers

According to H. L. Grant, sales manager of the Western Electric Company, Chicago has been the best fan market in the Middle West. Fans have been called in from a number of jobbers in neighboring cities and in spite of this there has been a demand greatly in excess of the supply. Last year the Western Electric Company had to carry about $20,000 worth over the winter, and the same condition prevailed the winter before and also the winter before that. The company named sold probably 100 per cent more fans this year than last, but the number of fans which were distributed to the retail buyers was probably 500 or 600 per cent greater than last year, since the dealers carried over considerable numbers. The Western Electric Company is not buying any more fans for this season as the fan season is considered over by Aug. 1 from the jobber's viewpoint.

The Central Electric Company of Chicago sold 5000 fans this year and could have sold 2000 more 12-in. oscillators if they had been available. In an attempt to fill orders that came early in August some fans were shipped even from Atlanta, Ga., delivery from other sources being out of the question.

The Illinois Electric Company reported an exceptionally large volume of business for this year, some of its fans going to other jobbers as well as to dealers. By the middle of the week all of its stock except some odds and ends was gone and while a few warehouse shipments were still arriving the demand exceeded the possible supply. It was expected that only the cancellations arriving with cooler weather could relieve the situation.

The B. R. Electric Company of Kansas City sold 3000 fans this year, representing an increase of 150 per cent over last year's business. This company's July business was more than double that of all previous 1916 orders. In the Kansas City territory the use of ceiling fans which a few years ago appeared to give way to oscillators, is again on the increase and the entire stock of these was gone early. Eight-inch and 9-in. fans proved more active this year than the 12-in. and 16-in. oscillators.

Northwest Shared in Demand

Even as far north as St. Paul, Minn., the fan trade was brisk, as is indicated by the fact that the Northwestern Electric Equipment Company sold 2200 fans which represented its entire stock except a few 220-volt units. When this company tried to replenish its stock deliveries of four to six weeks were quoted. The fan season in the Northwest territory was characterized as a wonderfully successful one for both jobber and dealer.

The Electric Appliance Company of Chicago disposed of its entire stock totalling 100 per cent more fans than it sold altogether last year. Four weeks' delivery was quoted on late July orders sent to the fan factories. The Mid-West Electric Company of Omaha sold 2000

fans, an increase of 500 per cent over its last year's business, cleaning out practically its entire stock. In the Omaha territory the 10-in. four-blade non-oscillating fan proved the popular choice and the 12-in. oscillators were the last to move out of stock.

On Aug. 8 the fan season was thought to be practically over in the Omaha district. The fan business of the Wesco Supply Company amounted to 10,000 fans this year as against 1200 last year. In addition to this the company reported that 2000 more could have been disposed of. Although the large oscillating fans were in active demand the increasing importance of the smaller types of fan in the field was very noticeable. The Miller-Shelton Electric Company of Detroit reported its entire stock sold out.

At Milwaukee the Julius Andrae & Sons Company this year sold more fans than it had handled in any previous year of its history. On Aug. 8 the Andrae Company still had a few fans in stock. The company's orders for this year's business had been large and it had carried over some fans from previous seasons. The 8-in. oscillator moved most actively.

AMERICA'S ELECTRICAL WEEK PLANS

Prize Winning Poster Which Will Be the Official Design of the Week Chosen and Literature Being Prepared for Committees

Building on past experiences, the plans of The Society for Electrical Development have been perfected for America's Electrical Week, Dec. 2-9, 1916. Local committees of representative electrical men have been organized in 286 cities. The immediate plans include the issuance of several "How to" booklets detailing the many things that can be done by individuals, committees, associations and electrical concerns to take advantage of the national campaign.

Next week an attractive booklet will be issued outlining the work that may be done by the industry in general and presenting the preliminary plan of action. The relationship between the various organizations will be shown and their various duties designated. Publicity campaigns for popularizing America's Electrical Week will be outlined This "Facts" booklet will be distributed to 25,000 men interested in making this campaign a success. It is not intended for the exclusive use of electrical men, but will be of general interest.

The $1,000 prize-winning poster will be reproduced on the cover of this book. As announced, nearly 800 designs were submitted and the task of the judges was not an easy one to select a poster which would embody the thought of electric service. This poster will be the official design of the America's Electrical Week campaign. It will be reproduced hundreds of millions of times on everything from a poster stamp to a billboard.

Committeemen in active charge of the various local plans will be supplied with the "Committeemen's Hand Book." This will be issued about Sept. 1. Ideal community celebration and sales campaigns for cities of 10,000 or less, 10,000 to 50,000 and 100,000 and more population have been analyzed and plans to fit the various conditions have been mapped out. Directions are given in detail.

A "cash in" booklet—the third of a series—follows the "Committeemen's Hand Book" but goes into minute detail in outlining how the individual manufacturer, jobber, central station, contractor and dealer may participate with benefit.

Booklets will also be issued and mailed which will tell how to put on electric shows, electric sign and American flag campaigns, electric parades, etc. The "How to" booklets of all descriptions will be free.

A feature of the work of the Society will be the publication of two papers to be known as the "Electrifier" and the "Exciter." The former is designed to be especially helpful to local committeemen while the "Exciter" will give the news regarding America's Electrical Week to all the men in the industry. The purpose of both is to be as helpful as possible in every way and to bring the work throughout the country before the attention of everyone interested.

PRIZE-WINNING POSTER

As evidence of the general interest in America's Electrical Week the society states that four magazines, *Collier's, Scientific American, Scribner's* and *Leslie's* will issue special electrical numbers or sections on Dec. 2.

The Society for Electrical Development has increased its working force and is now said to have one of the best publicity and sales staffs in the country working to assist the industry in making America's Electrical Week bigger and better in every way than Electrical Prosperity Week of last year.

PACIFIC COAST CONVENTION OF A. I. E. E.

Joint Session Will Be Held with Northwest Electric Light and Power Association During One Day of the Convention

As previously announced, the Pacific Coast Convention of the American Institute of Electrical Engineers will be held in Seattle, Wash., Sept. 5 to 9, 1916. The technical program has been completed and is as follows:

Sept. 5.—Registration; Address of Welcome; Address by President H. W. Buck; "A Distributing System for Domestic Power Service from Commercial and Engineering Standpoints," by Carl H. Hoge and Edgar R. Perry; "Some Features of Domestic Electric Cooking and Heating," by H. B. Pierce; "Temperature Rise of Insulated Lead Covered Cables," by Richard C. Powell.

Sept. 6.—"Inductive Interference as a Practical Problem," by A. H. Griswold and R. W. Mastick; "Testing for Defective Insulators on High-Tension Transmission Lines," by B. G. Flaherty; "The High Voltage Potentiometer," by Harris J. Ryan; "An Artificial Transmission Line with Adjustable Line Constants," by C. E. Magnusson and S. B. Burbank.

Sept. 7.—The program for both the morning and afternoon sessions for Thursday will be supplied by the Northwest Electric Light and Power Association. At the evening session the following lectures are scheduled: "The Engineer and the Public," by Henry Suzzallo, president, University of Washington; "Illumination of the Panama-Pacific Exposition," by W. D'A. Ryan.

Sept. 8.—"Characteristics of Admittance Type of Wave Form Standard," by Frederick Bedell; "Insulator Failures Under Transient Voltages," by W. D. Peaslee.

Refund for N. E. L. A. Exhibitors

The exhibition committee of the National Electric Light Association met at the offices of the association on July 27 for the election of officers for the year. The members in attendance were Chairman K. W. Perry, Frank H. Gale, S. E. Doane, J. C. McQuiston, J. Mustard and Secretary H. G. McConnaughy. J. M. Perry of H. W. Johns-Manville Company was re-elected chairman, Frank H. Gale of the General Electric Company, treasurer, and H. G. McConnaughy, secretary.

A large amount of business was transacted by the committee but the most important item that presented itself was the surprise in store for the exhibitors at the Chicago exhibition this year. In spite of many expenses the committee has found that these are well within its carefully made estimates, and under these circumstances it is issuing to all the Class D members who exhibited, the notification that it has decided to return to each exhibitor 15 per cent of the amount paid by him for exhibition space. This dividend, which is of a kind that is exceedingly rare in such matters, is due not only to the work of the committee itself, but to the hearty co-operation of the exhibitors individually and as a whole. This rebate is to be forwarded immediately.

Proposed Inspection Tour in Connection with I. E. S. Lecture Course

The committee in charge of the inspection tour, which it is expected will be an outstanding feature of the lecture course to be given under the auspices of the Illuminating Engineering Society and the University of Pennsylvania in September, has issued the following preliminary information:

The general purpose is to assemble as many as may be interested in taking this trip and take them as a party to visit places of notable lighting interest. At each city there will be a local committee having charge of the entertainment of the visitors and seeing to it that they obtain as much as possible of value in the way of information and interest.

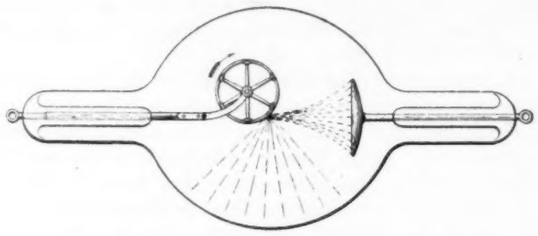
The cities of Pittsburgh and Washington will be visited in advance of the convention. During the lecture course there will be a week-end side trip to Atlantic City. Subsequent to the lecture course the party will visit New York, Boston, Schenectady, Buffalo, Niagara Falls, Cleveland and Chicago.

Arrangements will be made so that those desiring to do so may join the party at any point and leave it whenever desired, provided only that each delegate must register for that part of the trip which he proposes to take in order that arrangements for taking care of him may be completed.

The following is the itinerary: Pittsburgh, Sept. 16; Washington, Sept. 17; Philadelphia, Sept. 18 to 23; Atlantic City, Sept. 24; Philadelphia, Sept. 25 to 28; New York, Sept. 29 to Oct. 1; Boston and Lynn, Oct. 2; Schenectady, Oct. 3; Buffalo and Niagara Falls, Oct. 4; Cleveland, Oct. 5; Chicago, Oct. 6.

Improved X-Ray Tube

Prof. Elihu Thomson, in patent No. 1,192,706, assigned to the General Electric Company, discloses an X-ray tube in which overheating and melting of the electrode by the cathode ray bombardment is entirely



X-RAY TUBE WITH REVOLVING ELECTRODE

avoided. By making the target or electrode in the shape of a wheel and having the cathode rays impinge on the anti-cathode tangentially, the wheel will revolve and thereby offer successively a new surface during the operation of the tube.

N. E. L. A. ACTIVITIES

Executive Committee Indorses Appointments Made to Various Standing Committees and Prepares for a Strenuous Year's Work

The executive committee of the National Electric Light Association met at the association headquarters in New York on Friday, Aug. 4. Reports were received from the chairmen of the various sections of the association and much work for the coming year was mapped out.

President Wagner informed the executive committee that owing to the increased demands upon Secretary Martin he has deemed it advisable to give him some additional assistance and had therefore appointed G. B. Muldaur to the position of field assistant secretary, to act as long as his services are required in that connection and are satisfactory. Chairman Edkins of the Commercial Section presented a recommendation passed at the Association Island meeting regarding the appointment of A. J. Marshall as executive representative of the Commercial Section at headquarters, explaining that the section had felt for some time the need of a representative to work in a general capacity on such committee work as could not very well be carried out by committee chairmen, or which could be better done at headquarters. Both of these appointments were approved by the executive committee.

The recommendation of the accident prevention committee to the Chicago convention was taken up for consideration and a resolution was adopted requesting the chairman of the accident prevention committee together with the president of the association to select a professional committee on resuscitation to act in conjunction with the accident prevention committee. President Wagner suggested the enlargement of the scope of the accident committee to include co-operation with the Bureau of Standards, and inasmuch as W. C. L. Eglin of Philadelphia was thoroughly familiar with the work of the previous resuscitation commission, he was asked by Mr. Wagner to act as chairman of the combination committee.

Secretary Martin presented applications for membership received since the May meeting as follows: Class A, 24; Class D, 15; foreign membership, 1; Class B, 492; and Class E, 28. Four Class C members having been approved by the Class E committee, the total new members passed on at the meeting was 564. Exclusive of the membership on the Electrical Vehicle Section the membership of the national body at the time of the meeting was 14,159.

STANDING COMMITTEES

President Wagner submitted the following appointments as chairmen of committees: Public policy, W. W. Freeman, Cincinnati; committee of Class C membership applications, Walter Neumuller, New York; Pacific coast representation, R. H. Ballard, Los Angeles; finance committee, J. B. McCall, Philadelphia; committee on constitution and by-laws, R. S. Orr, Pittsburgh; committee on membership, Walter Neumuller, New York; exhibition committee, J. M. Perry, New York; transportation committee, George W. Elliott, New York; committee on Manufacturers' Section, S. E. Doane, Cleveland; committee on Doherty prize, Paul Spencer, Philadelphia; committee on Frasse prize, E. W. Lloyd, Chicago; committee on geographic sections, L. D. Gibbs, Boston; committee on company sections, F. A. Birch, Philadelphia; rate research committee, Alex Dow, Detroit; committee on safety rules and accident prevention, W. C. L. Eglin, Philadelphia; lamp committee, Frank W. Smith, New York; committee on progress, T. C. Martin; committee on education, John F. Gilchrist, Chicago; committee on valuation terminology, J. N. Shannahan, Newport News; committee on relations with other associations, R. S. Orr, Pittsburgh.

NEW COMMITTEE WORK

There were several new committees formed this year, the purposes of which were explained by President Wagner. The Pacific Coast representation committee will keep in touch with association activities generally and increase the activities on the Pacific Coast. Mr. Doane accepted chairmanship of the committee of eleven to consult the Class D manufacturing company members and advise as to ways and means of establishing a Manufacturers' Section and to decide upon the personnel of the first executive committee of the section. President Wagner reported that upon investigating the subject of valuation terminology and considering the personnel of the committee and the chairman, he had learned that practically the same ground had in a preliminary way been covered by the American Electric Railway Association and in order to avoid duplicating its work he had deemed it desirable to appoint as chairman of the committee J. N. Shannahan, vice-president of the Newport News & Hampton Railway, Gas & Electric Company, who is chairman of the American Electric Railway Association's valuation committee and whose company is a member of the National Electric Light Association.

In connection with the committee on education, President Wagner advised that he had appointed Vice-President W. F. Wells of Brooklyn as chairman of a committee to be composed of the chairmen of committees and the chairmen of national sections, the object being to exchange ideas and bring about better co-operation; the committee to be known as conference of sectional and committee chairmen.

The purpose of Mr. Orr's committee dealing with other associations is to keep in touch with public service associations and report to the president and executive committee on the possibility and advisability of co-operation along lines of work in which there may be common interest.

CO-OPERATION BETWEEN TECHNICAL AND COMMERCIAL SECTIONS

President Wagner reported that he had called a conference of the chairmen of the Commercial and Technical Sections, because he felt that there was need for closer co-operation between these sections due to the changes that have taken place in the industry by reason of greater sales of electric energy in industrial fields, with the result that commercial men constantly encounter technical problems requiring technical knowledge. As a result of this conference, there will be an interchange of representation on the committees of the two sections. The Technical Section will have three representatives on the Commercial Section wiring committee, three on the power sales bureau, one on the lighting sales bureau, and one on the new committee on commercial service and relations with customers, while the Commercial Section will have two representatives on the Technical committee on engineering service to small companies.

ELECTRIC VEHICLE SECTION WORK

Chairman Mansfield of the Electric Vehicle Section reported that the section is planning to carry on a campaign with the central stations, following President Wagner's example, with a view to having each company purchase one electric vehicle for use or resale. The section is also urging central stations to organize electric vehicle departments or to appoint an employee responsible for this work. The section plans to start an advertising campaign and to complete an electric vehicle film now started with the thought that the lecture bureau might possibly take this over.

Reports were also made by Chairman E. A. Edkins for the Commercial Section, by Douglass Burnett for the chairman of the Accounting Section, and by Secretary Martin for the chairman of the Technical Section.

COMMERCIAL SECTION COMMITTEES

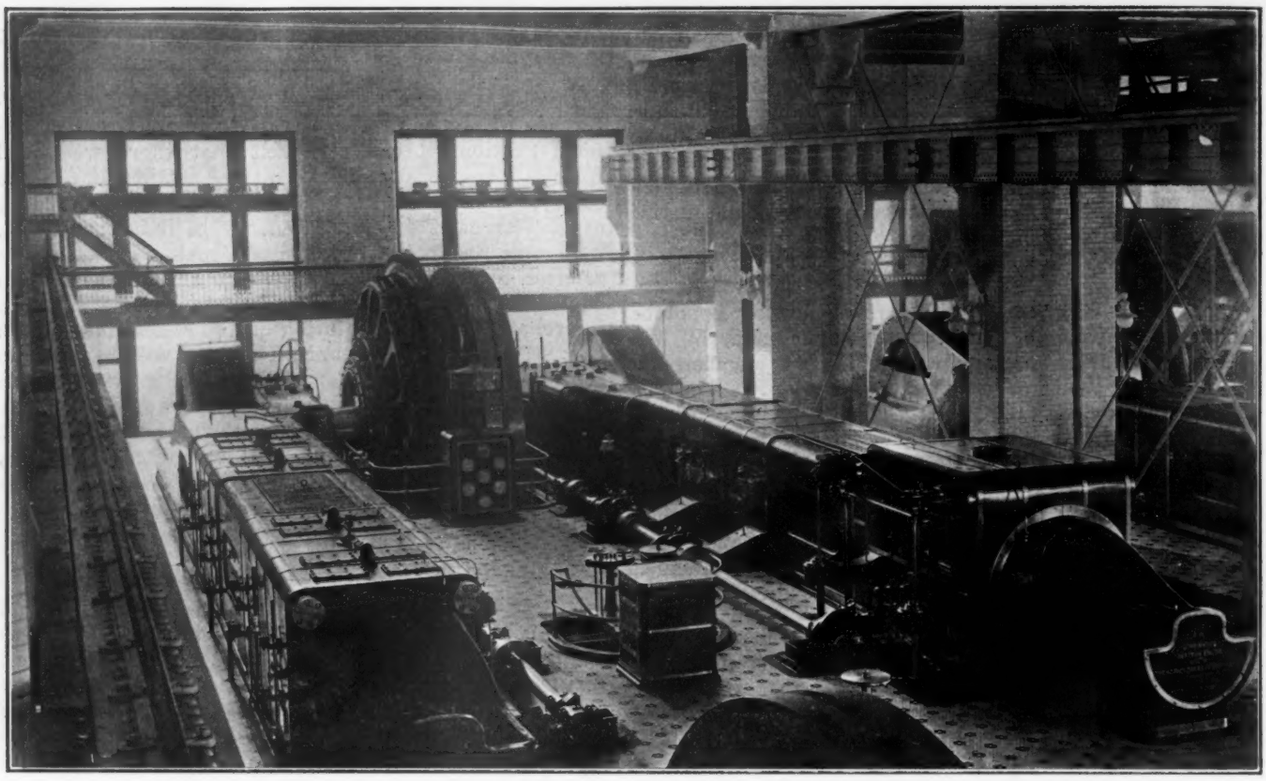
Although all of the committees have not yet been appointed, the following list submitted by the Commercial Section was accepted by the executive committee:

Finance committee, John G. Learned, Chicago; publications committee, F. D. Pembleton, Newark; salesmen's handbook committee, R. H. Tillmann, Baltimore; wiring committee, R. S. Hale, Boston; merchandising committee, J. V. Guilfoyle, New York; committee on education of salesmen, F. R. Jenkins, Chicago; electric range committee, C. E. Michel, St. Louis; power sales bureau, George H. Jones, Chicago; lighting sales bureau, T. F. Kelly, Dayton; industrial heating bureau, H. O. Loebell, New York; commercial service and relations with customers committee, R. F. Bonsall, Baltimore; committee on co-ordinate advertising and sales campaign, Henry Harris, Pittsburgh; committee on foreign relations, E. A. Edkins, Chicago.

ELECTRIC VEHICLE SECTION COMMITTEES

The following chairmen of committees appointed by the Electric Vehicle Section were also indorsed:

Legislative committee, P. D. Wagoner, New York; garage and rates, C. H. Miles, Boston; federal and municipal transportation, J. H. McGraw, New York; membership, G. A. Freeman, Chicago; operating records, Robert P. Grove, New York; manufacturers and central station co-operation, George B. Foster, Chicago; standardization, E. R. Whitney, Philadelphia; traffic and good roads, A. A. Anderson, Detroit; motion picture films, Carl R. Reed, Philadelphia; insurance, Day Baker, Long Island City; constitutional revision, Frank W. Frueauff, New York. The chairmen of other committees will be announced later.



ONE OF FOURTEEN 4000-KW. GAS-STEAM DRIVEN UNITS IN POWER PLANT OF FORD WORKS

The World's Largest Direct-Current Station

The power plant at the Detroit works of the Ford Motor Company, which has a maximum rating of 65,000 kw. at 250 volts, is without doubt the largest strictly direct-current installation in existence. Aside from this fact, the new and interesting features of design and control which have been worked out for this station make it an especially noteworthy engineering accomplishment. Fourteen reciprocating engines of a composite gas-steam design operate direct-current generators of 4000 kw. each and two others operate smaller units. The control of this equipment has called for a switchboard of 222 panels 424 ft. long, which cost $400,000. More than 8000 machines are operated over a floor area of 47.5 acres from a distribution system that calls for 178 feeders. Around 165 tons of copper is used between station switchboard and distribution centers. The details of this plant as outlined in what follows are largely based upon a paper presented by the author at a recent meeting of the Detroit section of the A.I.E.E.

By FRED ALLISON

Electrical Engineer, Ford Motor Company, Detroit, Mich.

THE equipment now installed and the additions soon to be placed in operation at the power plant of the Ford Motor Company in Detroit, consists of fourteen 6000-hp. and one 4000-hp. reciprocating engines of the composite gas-steam type and one 1500-hp. straight steam engine. These engines are direct connected to 250-volt, direct-current, two-wire Crocker-Wheeler generators of 4000-kw., 2500-kw. and 1000-kw. respectively, operated in parallel, which gives the station a maximum rating of 65,000 kw. Turbogenerators were at first considered for this station but owing to the inadequate water supply at the plant location, the gas engine supplemented by steam was decided upon. While alternating-current generation could have been employd the factory conditions were such as to favor direct-current operation and it was considered that the added cost of copper for the latter system would not be more than the extra apparatus required for alternating-current operation.

In order to comprehend the nature of the problem regarding control, certain features of the composite gas-steam engine must be understood. In the interest of economy, it is desirable that the proportion of the load on the steam side be held to a minimum, consistent with proper governing in response to load variations as the thermal efficiency of the gas side is greater than that of the steam side. Since it is almost impossible to make gas of a constant quality, the performance of the gas side of a given engine will vary somewhat according to the quality of the gas, the conditions of the igniters, etc. Therefore, if this side of the engine shows unfavorable symptoms the load of that unit is automatically taken over by the steam side. In operating such large units it is of great importance that the watch engineer has full control of the load on his engine. It will be seen, therefore, that the division of the load between units operating in parallel must within certain limits be handled between engines and switchboard so that the control of the load is handled at the engine. Safety consideration as to the governing makes it desirable

that the sudden loss of the working load incident upon the opening of the circuit breaker shall instantly stop the production of power on the gas side. This end is obtained by interrupting the ignition circuit coincident with the opening of the circuit breaker through the medium of a switch provided for that purpose and functioning with the circuit breaker. Fed from the control magnet and likewise controlled by this switch is the gas throttle control magnet, the de-energization of which results in shutting off the gas supply.

The generators with a rating of 4000-kw. at 250 volts and 80 r.p.m. are an unusual size. They are of the commutating pole type with compound field construction. The armature of each is 15.5 ft. in diameter and carries about a ton and a half of copper in coils, while the commutator is 9.5 ft. in diameter and contains over two tons. The bus rings, together with the interpole, series and shunt fields, contribute a ton and a half more of copper, making a total of more than five tons used in the construction of one of these machines. The shaft carrying the armature is 34 in. in diameter and revolves in bearings, one 60 in. long on the steam side and one 50 in. wide on the gas side. The Crocker-Wheeler Co. furnished the parts, but the generators were assembled and tested in their present positions.

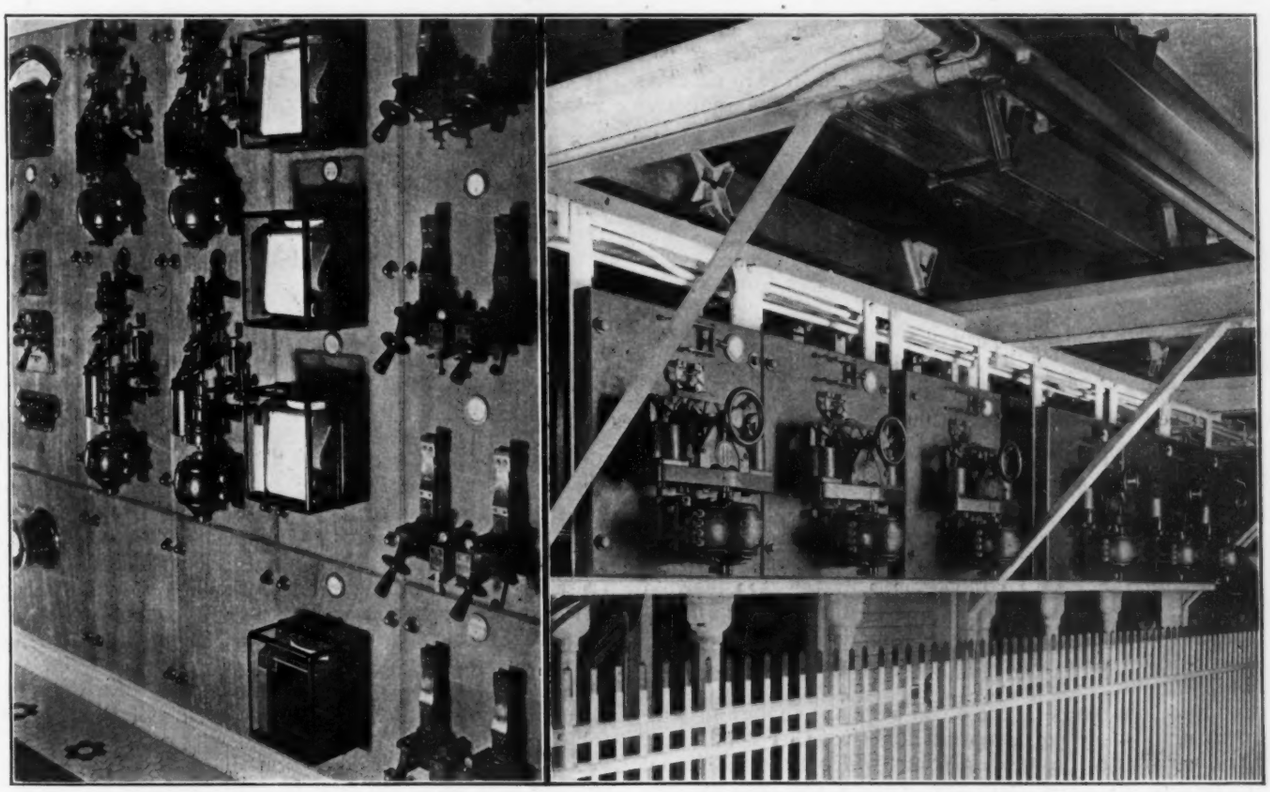
High above each machine three Quartz type lamps enclosed in large 22-in. Alba globes provide ample illumination, while from a bracket on each pillar two 400-watt gas filled lamps contribute a unique, decorative effect and emphasize the harmony of white enameled brick walls and mosaic floors.

FEATURES OF GAS ENGINE OPERATION

The gas engines are of a two-cylinder four-stroke-cycle design, the cylinders being equipped with a double set of plugs insuring a fire from both ends. The bore and stroke of the gas engine cylinders is 42 and 72 in. respectively. The piston rods of chrome vanadium steel forgings are 13 in. in diameter and approximately 16.5 ft. in length. The valves, however, are proportionately lighter than are usually found in gas engine construction. One gas engine alone has a weight of 250 tons and develops at full load 3300 hp. This is believed to be the highest horsepower output per ton of any gas engine built to date. Water cooling is used for cylinders, housings, piston rods, valve boxes and main bearings. The cooling water leaves the engine at approximately 175 deg. Fahr. This is used to supply the necessary boiler feed and the remainder for the hot water factory supply.

Burned gases are exhausted from the cylinders at a temperature of about 1100 deg. Fahr. They immediately pass through a superheater located in the steam line between the low and high pressure steam cylinders. From here the exhaust gas is shunted around the steam cylinder jacket, then passes through an economizer or feed water heater which further raises the temperature of the feed water taken from the return cooling mains. From here it goes to the stack. In order to offset as much as possible the deleterious effect of gas on the economizer tubes these have been built of ingot iron.

Ignition is of the make and break type, power being furnished by a storage battery through a 3-wire system. The neutral is grounded to the frame of the engine while the positive and negative sides are both led into the engine so that the charge is exploded simultaneously by two igniters. These positive and negative leads are brought to the engine through a switch automatically operated when the equalizer switch is closed. In parallel with this switch, which is electrically closed from the engineer's stand by the operation, is a button marked "safety." A second break in this line is closed by the engineer operating the switch marked "spark." The proper running condition of the circuit is with the last mentioned break closed, but with the parallel switch at the circuit breaker open. If for any reason the breakers open on a machine it will open the ignition circuit, thus effectively cutting off power generation on the gas



FIGS. 1 AND 2—GYROSTATIC VOLTAGE BALANCE DETECTORS ON GENERATOR CONTROL PANELS AND MOTOR OPERATED FIELD RHEOSTATS AT REAR OF SWITCH BOARD

side of the prime mover. The governor takes care of the steam side. Current is distributed to the various cylinders in proper sequence by a simple commutating device. The bars on this distributor are prevented from burning by so timing the throw of the igniter that it is at maximum opening when the brush leaves the commutator segment. In the igniter the break is made electromagnetically by passing the current through a coil before it is conducted to the gap. When the circuit is closed by the distributor the magnetic action of this coil is to pick up an iron plunger which in turn actuates a rod leading to the sparking points. The inductive action of the coil tends to maintain the voltage at the break, thus intensifying and lengthening the spark. Excellent results are being obtained from this method of ignition.

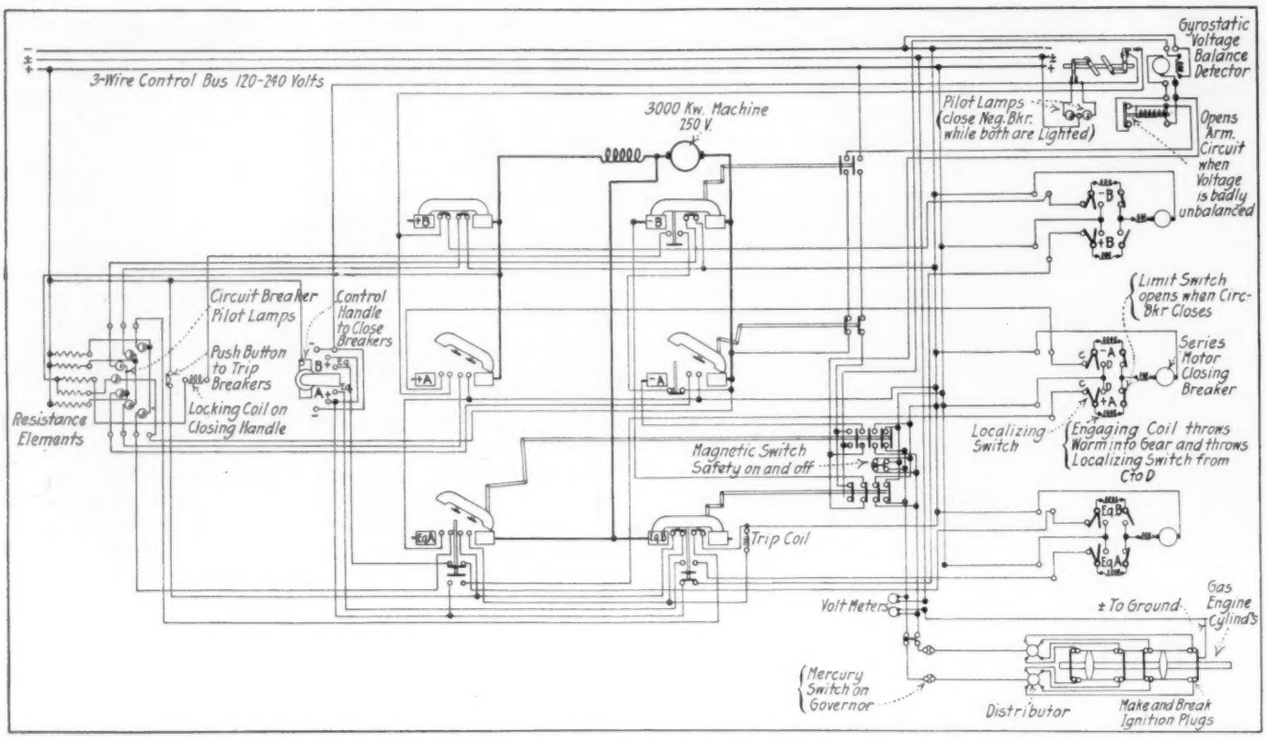

3-Wire Control Bus 120-240 Volts
3000 Kw. Machine 250 V.
Gyrostatic Voltage Balance Detector
Pilot Lamps (close Neg. Bkr. while both are Lighted)
Opens Arm. Circuit when Voltage is badly unbalanced
Limit Switch opens when Circ-Bkr Closes
Series Motor Closing Breaker
Circuit Breaker Pilot Lamps
Control Handle to Close Breakers
Push Button to Trip Breakers
Locking Coil on Closing Handle
Resistance Elements
Localizing Switch
Engaging Coil throws Worm into Gear and throws Localizing Switch from C to D
Magnetic Switch Safety on and off
Trip Coil
Volt-Meters
± To Ground
Gas Engine Cylinds
Mercury Switch on Governor
Distributor
Make and Break Ignition Plugs

FIG. 3—WIRING FOR CIRCUIT-BREAKER CONTROL AND IGNITION SYSTEMS

STEAM ENGINE OPERATION

The steam engines are double expansion Corliss valve design with cylinders in tandem on the piston rod. The diameter of the high pressure cylinder is 36 in. while the low is 68 in. The stroke, which is the same as for the gas engine, is 72 in. Steam of 700 deg. Fahr. temperature enters the high pressure cylinder at 180 lb.

The usual troubles with lubrication have been overcome by using a low velocity superheater constructed in such a manner as to lead the steam through pipes of gradually decreasing diameter, thereby giving it a constant velocity with a consequent uniformity of heat transfer. As already stated, water is somewhat scarce at the plant so that it is necessary to cool and reuse condenser water. The cooling is accomplished by forcing the water through sprays on the roof of the building just back of the power house. The water is reduced to a temperature of 35 deg., the change in temperature depending somewhat upon weather conditions. The sprays are grouped in ponds which have individual capacities of 4200 gal. per minute and receive the water before it flows back to the condenser which is situated in the basement.

The coal bunkers, stokers and boilers are located on the third floor. The boilers now under construction are of the Badenhouse type and have a normal rating of 4000 hp. each. Eighteen hundred tubes give these boilers an approximate heating surface of 26,000 sq. ft. and the fourteen when in operation for a period of twenty-four hours will consume 2000 tons of coal and evaporate 22,000 tons of water. All coal used is elevated from the storage bunkers to the boiler room bunkers by means of Mead Morrison conveyor system. The coal passes from the boiler room bunkers through a hopper, to a weighing device on a traveling crane, from this point it is received by the Taylor stokers and fed directly to the fires. The second or mezzanine floor is given over to the main steam header piping, the vacuum ash handling mechanism, oil filters of Peterson type that are required to handle 3000 gal. per hour and the economizers that utilize the exhaust from the gas engine to heat the boiler feed water.

GENERATOR CONTROL

The I-T-E circuit breakers controlling the respective generators are all of the same general type. They are of triple pole, double throw design, thus controlling positive, negative and equalizer leads and providing alternative connections with either of the two sets of buses. While equipped for remote control, they are nevertheless, in spite of their large size and liberal contact areas, capable of being easily closed by hand. They are equipped with direct acting overload time limit features and reverse current actuation, thus insuring the generators protection against short circuits or unduly sustained overloads and also against motoring currents.

The remote control mechanisms are operated by means of motors, there being one of these mechanisms for each pole. Directly associated with these are interlocking devices, so arranged that the poles of the circuit breaker may be closed only in predetermined sequence; *i.e.* equalizer first, then positive and finally the negative poles. While the circuit breaker is in the full open

position, positive and negative switch members of both throws are locked out and only the equalizer members are free to be moved to the closed position. Whichever throw of the equalizer is closed, the other is thereupon locked open, while the positive pole which corresponds with the closed equalizer pole is at the same time unlocked. The subsequent closing of this member unlocks the corresponding negative pole. The interlocks above referred to are mechanical and are effective whether the apparatus is operated electrically or by hand. Electrical interlocks are also provided as a further safeguard when the apparatus is closed electrically. On the respective machine panels are the switches controlling these interlocks, which associated with the positive pole also control the circuit of the ignition and of the throttle release magnet.

ARRANGEMENTS FOR PARALLELING UNITS

Of almost equal interest to that of the circuit breakers and contributing in no small degree to the ease with which the various generating units may be controlled, are the I-T-E motor operated field rheostat mechanisms which are shown in Fig. 2. The use of these mechanisms allows the placing of the rheostat at a distance from the switchboard and at the same time permits the regulation of the voltage of all the generators to be effective from a centralized control board, this greatly facilitating the operation of throwing a generator into parallel with others and of securing proper subdivision of the load between the various units.

All engineers are familiar with the care necessary in putting a generator in parallel with others already loaded and they recognize the importance of having the voltage of the incoming generator bear a proper relation to that of the busbars before connection between them is established. It is well understood that failure in this respect may result in serious disturbance to the

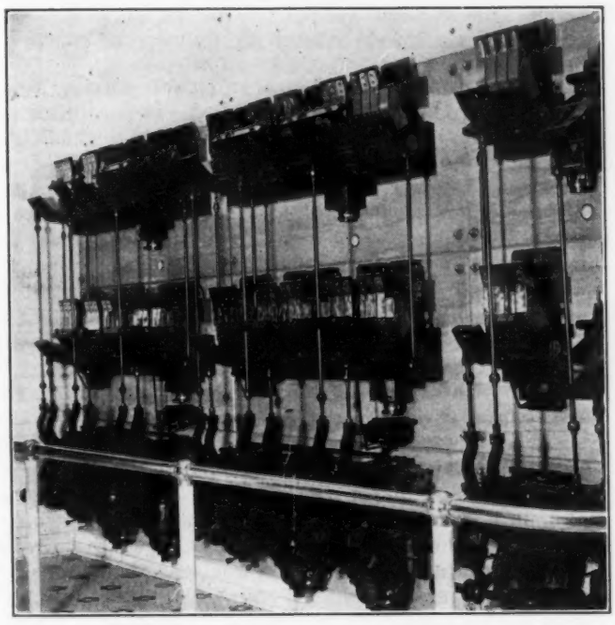


FIG. 4—GENERATOR CIRCUIT BREAKERS AND 8000-AMP. BUS TIE SWITCH

regulation of the respective generators and their prime movers. Important in all cases these considerations become momentous where the units affected are of large size and where continuity of service is of prime importance. These requirements are met by an I-T-E gyrostatic voltage balance detector shown in Fig. 1. This device is made to control the circuit of the closing motor associated with the negative pole of the generator circuit breaker shown in Fig. 4. It consists primarily of a pair of switches in series with each other and connected in the above mentioned motor circuit. The movable members of these switches are under the control of respective gyroscopic governors mounted upon a vertical shaft adapted to be rotated by a motor located immediately below it. During the period of use and in a manner to be subsequently described, the field winding of this motor is connected across the mains of the 250-volt control circuit while its armature is at the same time subjected to the potential difference which exists between the associated generator and busbars. The direction of rotation of this armature depends, therefore, upon whether bus or generator voltage predominates and its speed in either direction depends upon the extent of the voltage difference. By means of a specially designed clutch placed between the motor and the governor shaft the motion of the former is transmitted to the latter only when the direction of rotation is that caused by a predominance of generator voltage over bus voltage. When rotating in the opposite direction the motor runs free. At the left of each voltage balance dector may be seen an automatic cut-out which interrupts the motor armature circuit should the voltage difference attain such a magnitude as to produce a dangerously high speed of rotation. As will be seen from the illustration, the lower right hand or "low-speed" contact is normally open and the upper or "high-speed" contact normally closed. The circuit breaker, the closing of which this apparatus controls, is of three separate poles, closed in predetermined sequence. The equalizer pole is closed first and with it auxiliary contacts which control the field and armature circuits of the gyrostat motor. Before it is called upon to function, the motor has time to assume the speed of rotation corresponding with the voltage impressed upon the armature. When the motor armature is energized in the direction corresponding to generator voltage predominating over bus voltage, the governors, which are under control of calibrated springs, will assume positions corresponding with the particular speed of rotation, the action of the governors being independent of each other up to a certain speed, beyond which as the result of links connecting them with a slight lost motion they act as a unit. It has already been stated that the rotation of the governors only occurs when the direction of voltage difference is favorable

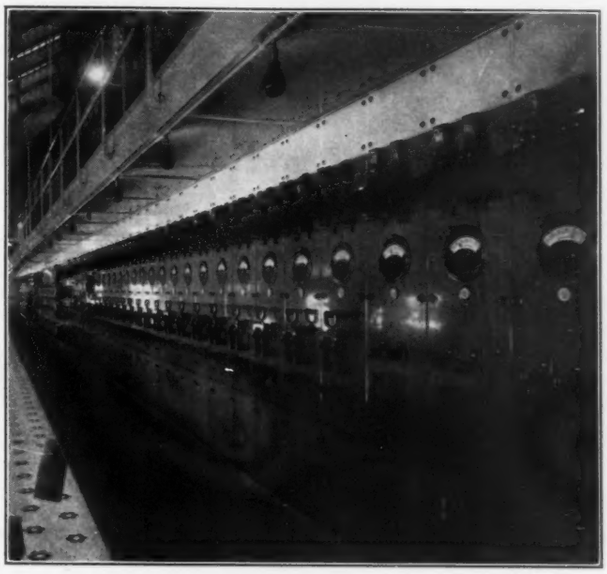


FIG. 5—MAIN SWITCHBOARD SHOWING FEEDER PANELS

to paralleling; when the magnitude of this voltage is such as to give the governor shaft a certain speed of rotation, then the low speed contact is closed. The minimum voltage difference necessary to accomplish this is, in the case of the particular apparatus in question, 2 per cent of the normal bus voltage. Should the voltage difference, however, amount to 2½ per cent or more, the upper or high speed contact is opened.

SWITCHBOARD 424 FEET LONG

The switchboard has a total length of 424 ft. and consists of 222 dark Tennessee marble panels. These have the usual circuit breaker, ammeter and 1000-amp., double pole, double throw knife switch. The machine panels are taken up elsewhere. A number of panels are devoted to the totalizing, governing, balancing, etc. All feeder panels have double throw knife switches, with breakers in duplicate on feeder panels. This is for the purpose of connecting either way on a 3-wire bus system. At some future date it is proposed to build a 500-volt generator rated at 20,000 kw. and this will naturally be connected to the outside bus of this system.

The switchboard as laid out is a revelation in industrial plant control. It represents in itself an investment of $400,000 or nearly $1,000 per linear foot.

Current is conducted from each generator by copper buses. There are thirty of these buses from each machine, composed of 6 in. by ¼ in. copper. The buses are led direct from machines to the circuit-breaker panels through a specially designed runway which is absolutely screened and guarded, thus eliminating any possibility of contact. In the basement runway the bus is suspended from the ceiling by hangers placed at intervals of 4 ft. After the bus reaches the circuit-breaker panel it is carried upward to the main bus directly behind the second floor balcony. The main bus at this point is supported rather than being suspended, and is anchored from the ceiling as a precaution against buckling, which is possible in case of short circuit, for the high current caused by an accidental short would produce a magnetic force which in turn would offer a high attraction to iron contained in the ceiling.

The main bus extends to the entire length of the second balcony board, but tapers down to meet the relative demands of distribution with an ample margin of safety. All copper was installed with a working density of 750 amp. per square inch. The rear of the second balcony alone contains 120 tons of copper, while the total amount used throughout the entire installation, which comprises one-half of the total present output, is approximately 165 tons.

FEEDER AND DISTRIBUTION SYSTEM

In the Ford factory, which has a covered floor space of 47½ acres, over 8000 power machines are operated. The large number of motors, together with the lighting, ventilating and other motors not used for production, naturally required the most economical system of distribution possible. From the feeders, of which there are 178, current is distributed to the various departments by means of cable of 1,000,000 circ. mils. As shown in Fig. 6, after leaving the panels the cables are conducted on an aerial over the machine shops to different parts of the factory. The rack provides for ninety pairs of 1,000,000-circ. mil cable. At present, however, only fifty pairs are installed. It is so designed that its carrying capacity may be doubled without taxing the roof or rack. The furthermost buildings from the powerhouse are fed by underground conduits. After entering the various buildings the cables are led to a distributing board, which consists of a number of panels, as is shown in the main board.

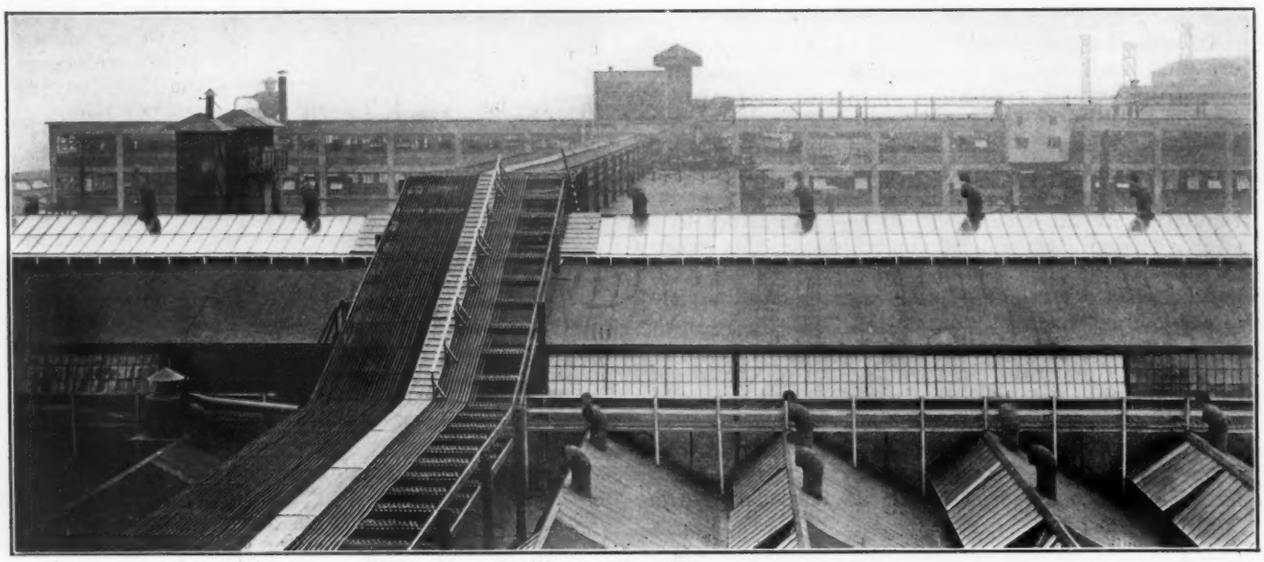


FIG. 6—RACK THAT PROVIDES FOR 90 PAIRS OF 1,000,000 CIRC. MIL FEEDER CABLES TO DIFFERENT SECTIONS OF THE WORKS

For the purpose of giving as far as possible continuous service on all lines at all times, an elaborate dispatching and signaling system has been installed. On the second balcony a 200-pair telephone switchboard connects with every distribution center throughout the factory, and with the boiler room, ash room, gas house and all engine-operating stands. Located in the office there is in connection with this dispatch board a signal board consisting of four panels, each carrying 300 signal lamps. When a feeder circuit is in operation a green lamp shows on the board, but when the circuit is out of operation a red light replaces the green. A duplicate set of telephone terminals is used with the board. This makes it possible to locate any trouble with the system and readily remedy the same.

The prime movers were designed and constructed under the direction of the Ford Motor Company. The steam ends were built by the Hooven Owen Rentschler Company at Hamilton, Ohio. The generators were furnished by the Crocker-Wheeler Company, Ampere, N. J. The circuit breakers and other features of electrical control were built by the Cutter Electrical & Manufacturing Company, Philadelphia, under the direction of F. Allison, electrical engineer of Ford Motor Company.

Graphical Solution of Transmission Line Problems

Use of a Chart for the Determination of the Factors Involved in Transmission Line Calculation Based on Energy Loss

BY T. A. WILKINSON

Head of Statistical Department, Westinghouse Church Kerr & Company

THE analytical solution of transmission line problems is a tedious operation, and various graphical methods have been devised to facilitate the solution and minimize as far as possible the time and labor required. These methods are based, primarily, on the factor of voltage drop, or regulation, but do not, in most cases, take into account the charging current of the line and their use is, therefore, limited to relatively short lines of moderate voltage where the condenser effect of the circuit may be neglected. As solutions of the problem in the form in which it generally occurs in practice they are indirect, requiring the assumption of the size of wire in advance, and from one to several trials, before the correct size is found, or else a conversion of the problem into terms of a single-phase equivalent. In all cases, more or less supplementary calculation is required, the graphical solution being only a partial one.

A method by H. B. Dwight, published in the ELECTRICAL WORLD of Jan. 16, 1915, however, gives a direct solution based on voltage drop, for the problem in either form, *i.e.*, it is possible to find the size of conductor with a given voltage drop or conversely to determine the regulation when the size of wire is given. By means of a simple correction factor the capacity effect is allowed for and the range of the chart is extended to lines up to 100 miles in length, with a close accuracy.

With the increasing use of synchronous condensers for the control and regulation of voltage drop independently of the size of conductor, the inherent regulation characteristics of the line become of relatively less importance in the design of present-day systems. This factor, as affecting the choice of conductors, is wholly eliminated in the case of constant voltage transmission systems, in which the voltage may be maintained not only constant but equal at the generator and receiver ends of the line. In these cases the allowable limit of energy loss becomes the sole criterion in determining the size of conductor unless, where the smaller sizes of wire are called for, corona effect or the limiting size for mechanical strength may require consideration.

The accompanying chart, which was devised by the writer some years ago, has been found useful in practice. It gives a complete graphical solution of the formula commonly used for the total weight of conductor in a three-phase transmission circuit, based on the allowable limit of energy loss in per cent of the power delivered. The formula is

$$W = \frac{KPl^2}{pV^2F^2}$$

where W is total weight of conductor; P is power delivered; l is transmission distance; p is energy loss in line, in per cent of power delivered; V is receiver line voltage; F is load power factor; K is a constant, depending on the system of transmission, conductor material and units used.

For a three-phase system with copper conductors, and the units shown on the chart scales, the constant is 262,500, and the formula becomes,

$$\text{Total weight of copper (thousand pounds)} = \frac{262{,}500 \times \text{kilowatts} \times (\text{miles})^2}{\text{per cent energy loss} \times (\text{volts})^2 \times (\text{power factor})^2}$$

The method of using the chart is indicated by the solution of the following problem: What is the size and total weight of wire for a three-phase copper circuit to deliver 16,000 kw. a distance of 50 miles at 60,000 volts, with a line loss of 10 per cent of the delivered power, the power factor of the load being 0.85?

Beginning at A (50 miles), follow the course of the broken line successively through the points B, C, D, E, F, G, representing the above given values of the different quantities and two intermediate reference points. At H, vertically above G on the lower weight scale, will be read the total weight of copper required, namely, 400,000 lb. Continuing vertically upward to an intersection at J, with the horizontal line at 50 miles, the size of wire, 3/0, will be read on the diagonal through J. Should the point J fall between two diagonals, the point should be shifted to the right or left to intersect the next larger or smaller size, as may be desired. The point H will be shifted correspondingly, and the weight of conductor for the gage size chosen will be read vertically below the new position of J.

Due to the convenient practical relation existing between the sizes of copper and aluminum conductors of equal conductivity, the use of the chart is extended in a very simple way to include aluminum conductors. The relative conductivities of commercial copper and aluminum for equal cross-section are approximately as 97:61, or as 1.59:1. This is the ratio of cross-section and conductivity between copper wires two gage sizes apart. The equivalent of a copper conductor of a given size, therefore, is an aluminum wire two sizes larger. Each diagonal may thus represent either a copper conductor or an aluminum conductor of equivalent size. The corresponding sizes of copper and aluminum are indicated on the diagonals. While for practical reasons the above relation is assumed in the construction of the chart, it should be stated that the copper wire scale is based, as is more fully noted below, on a conductivity of 100 per cent. The assumed relation in size is therefore only strictly true for aluminum of a conductivity of $100 \div 1.59 = 63$ per cent, or 3 per cent higher than that of commercial hard-drawn aluminum. As the difference in cross-section and weight of consecutive gage sizes of wire is 26 per cent, this small difference cannot affect the choice between one gage size and another.

The relative weights of a copper conductor and an aluminum conductor two gage sizes larger are as 100 to 48, and the total weights for equivalent aluminum conductors are given on the upper weight scale, the value at any point on the aluminum scale being 48 per cent of the corresponding point on the copper scale. In the example used the size of the equivalent aluminum conductor is 267,000 circ. mil, and its weight, read at K on the upper scale, is 195,000 lb. The exact weights of copper and aluminum based on the formula are 403,700 lb. and 193,800 lb. respectively.

While the chart is intended primarily to cover the range of high tension transmission line practice, the range can be extended very simply to cover lines of any length or voltage beyond the range shown on the scales. This will be clear from the following considerations.

By reference to the formula it will be noted that the

total weight of conductor is proportional to the quantity $\frac{\text{miles}^2}{\text{volts}^2}$, or inverting the fraction, the weight is inversely proportional to (volts per mile)^2. Any combination of line voltage and miles, therefore, in the same ratio as the actual case will require the same total *weight* of conductor. All that is necessary, therefore, in the case of a short line is to multiply the volts and miles by a number that will bring the problem within the range of values on the chart. Simple multiples of two, five or ten will meet practically all cases.

In finding the size of conductor corresponding to the weight determined as above, it will be noted that the weight as determined is for a line $1/N$ times as long as the multiplied value, where N is the multiplier used. This is equivalent to saying that for a line of the multiplied length the weight will be N times the weight found. By multiplying the actual weight, therefore, by N, and locating this value on the scale, the size of conductor will be found vertically above it at the intersection with the horizontal line for the multiplied length of line. To illustrate, assume the following conditions where, in order to avoid confusion, only the distance and voltage are changed from the first example:

Transmission distance	15 miles
Voltage delivered	18,000
Energy loss, per cent	10
Power factor of load	.85
Kilowatts delivered	16,000

To find the weight and size of copper required, by using a multiple of two with the derived values of miles and voltage, 30 miles and 36,000 volts respectively, proceed as in the original example. The new point B will be at the same vertical height as before (this height representing volts per mile), and the line B, C, D, E, F, G, H will coincide with the original problem, the weight of copper being 400,000 lb. as before. This is now the actual weight for a line 15 miles long. Multiplying by two we get a derived weight of 800,000 lb. (point L). At M vertically above L on the horizontal line at 30 miles the size of conductor is found to be about 550,000 circ. mil.

By means of the chart any one of the quantities involved, other than the length of line, can be found if the remaining quantities are known. For instance, referring to the first example given, assume that the problem had been to find the per cent energy loss in a three-phase 3/0 copper circuit 50 miles long, delivering 16,000 kw. at 60,000 volts, with a load power factor of 0.85. Beginning at A, follow the broken line to B, which defines the position of a line horizontally to the right. Beginning at J, follow the broken line in a reverse direction through G, F, E, D, thence diagonally upward to an intersection with the horizontal from B. The intersection of these lines will be at the point corresponding to the per cent energy loss, in this case, of course, at C, 10 per cent.

Problems in single-phase or two-phase transmission can be readily solved. For equal energy loss, under the same conditions of voltage and power delivered, a single-phase circuit will carry one-half the power, and a two-phase circuit will carry the same amount of power as a three-phase circuit having the same size of wire. To find the size of wire for a single-phase line, therefore, proceed as if for a three-phase circuit carrying twice the power. As there are only two wires, however, instead of three, the weight found by the chart must be reduced by one-third. To calculate a two-phase circuit, find the size of wire for a three-phase line of equal capacity, and to the corresponding weight add one-third to allow for the fourth wire.

The necessary adjustments of weights described above for the solution of the special cases can very conveniently be performed graphically. To multiply the weight found for short lines by the factor N, simply measure to the right of the point H a distance equal to that between the scale value 100 and the values 200, 500 or 1000, according to whether the factor N is 2, 5 or 10, etc. This will give the point L, above which will be read the size of wire at M. To correct the weight value for a single-phase circuit measure to the left of the point H, as found for the three-phase circuit, the distance between the scale values 300 and 200. To correct for two-phase circuits measure to the right of H a distance between the scale values 300 and 400. These adjustments, which reduce the original weight in the proportion of three to two and increase it in the proportion of three to four respectively, are simply the familiar processes of multiplication and division by the graphical addition and subtraction of logarithmic values.

Calculations for the copper weight scale are for solid wire throughout, and are based on the international annealed copper standard at 20 deg. C. This standard is defined and very complete wire tables based thereon are given in Circular No. 31 of the U. S. Bureau of Standards (October, 1914, edition). From this standard basis a single percentage correction can most conveniently be made to incorporate all of the allowances required for other conditions of temperature and conductivity, stranding, sag, etc., to meet any particular case. This correction can be made graphically in the same manner as described above by measurements from the reference point 100 on the weight scale.

It should be noted that the chart is based on the load current I^2R losses in the conductor, and is exact throughout its range for these losses only. The true power loss, as calculated by the hyperbolic theory of transmission lines, and which includes the dielectric losses, is governed by the reactive conditions of the circuit. It may be more or less than the load current I^2R loss, its ratio to I^2R loss varying within the range of the chart and practical operating limits approximately between the following values:

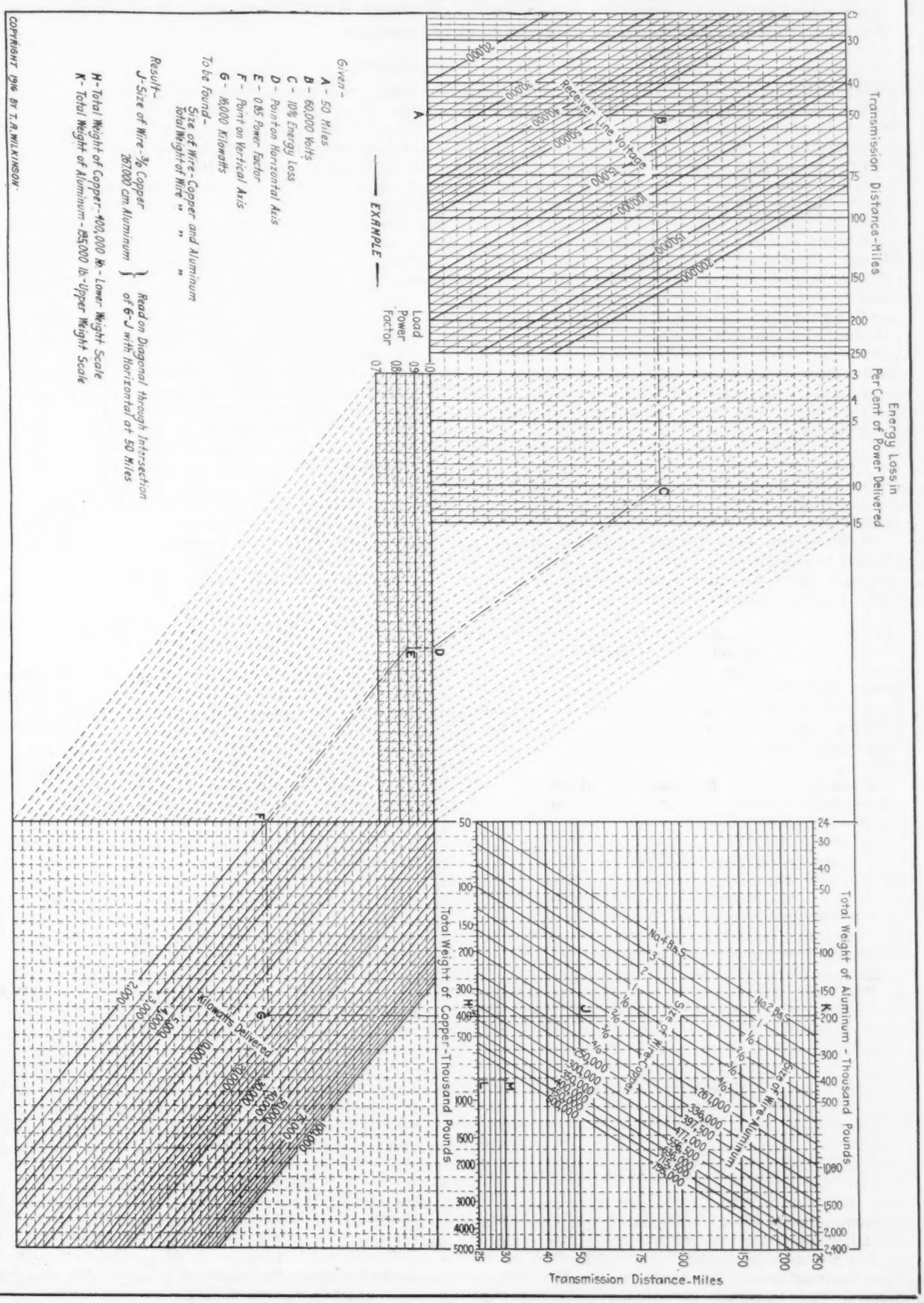
Power Factor	Limits of Ratio
Unity	0.95 to 1.05
Leading—with constant voltage regulation	1.0 to 1.15
Leading—any conditions	1.0 to 1.30
Lagging	0.7 to 2.50

The difference shown above for untiy and leading power factors may be disregarded in most cases for practical purposes, but the possible large difference between the two losses in the case of lagging power factors should be fully recognized.

It may be added that the chart is intended primarily to facilitate the determination of conductor sizes, and the determination will be based in most cases on full load conditions, the losses at light loads being of minor importance. This condition favors to some extent the accuracy of the chart for its main purpose, as the difference between true power loss and I^2R loss, while not much affected at unity power factor, decreases with higher loads, with leading power factors. Where exact results are desired and analytical calculation is necessary, the use of the chart will eliminate a good deal of waste effort since all possible conditions can be quickly covered and the range for exact analysis restricted.

The range of the chart is extended somewhat beyond the highest values of distance, voltage and size of conductor as yet reached in practice, this being done in order to cover the greater range of conditions made possible by the constant voltage system of operation. It will be interesting to note that the extreme conditions of the chart are approximated in one actual case, namely, the 240-mile, 150,000-volt constant voltage line from the Big Creek plant of the Pacific Light & Power Company in California, having aluminum steel core conductors, the equivalent of 375,000 circ. mil copper, and designed to deliver 57,500 kw. per circuit.

Chart for Calculation of Three-Phase Transmission Lines


Given-
A - 50 Miles
B - 60,000 Volts
C - 10% Energy Loss
D - Point on Horizontal Axis
E - 0.85 Power Factor
F - Point on Vertical Axis
G - 10,000 Kilowatts
To be found-
Size of Wire - Copper and Aluminum
Total Weight of Wire " " "
Result-
J - Size of Wire - No. Copper
267000 cm. Aluminum
Read on Diagonal through Intersection of G-J with Horizontal at 50 Miles
H - Total Weight of Copper - 400,000 lb. - Lower Weight Scale
K - Total Weight of Aluminum - 825,000 lb. - Upper Weight Scale
EXAMPLE
Receiver Line Voltage
Load Power Factor
Transmission Distance - Miles
Energy Loss in Per Cent of Power Delivered
Kilowatts Delivered
Total Weight of Copper - Thousand Pounds
Total Weight of Aluminum - Thousand Pounds
Transmission Distance - Miles
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Faulty Parallel Operation of Motor Generators

How the Cause of Trouble Was Located, the Remedy Ascertained, and Method By Which It Was Administered

BY N. P. HOISINGTON

THE operators of a large coal mine generating station recently experienced difficulty in operating two similarly-designed and equally-rated interpole compound-wound motor-generators in parallel. In the investigation which followed the commutator and brushes were examined, the air gaps compared for similarity, the connections between series field coils, interpole coils, and equalizer switches checked, the neutral positions of the brushes determined and the compounding of the machines compared. This inspection revealed that the commutator required "stoning," the brush-holders needed cleaning and the series-field shunt required adjustment, but after these matters were attended to the trouble still remained.

With heavy loads the motor generators shared the current proportionately but with light loads they did not. Moreover, when the machines were suddenly disconnected from a load under the unbalanced condition the heavier loaded generator operated the other unit as a motor, sometimes causing such a cross-circulation of current that the machine circuit breakers opened. This condition could hardly exist with non-interpole, compound-wound generators provided the brushes were on neutral points because they operate practically as shunt-wound machines on no load. The trouble was therefore attributed to the interpole adjustment since too strong an interpole field may result in rising armature characteristics causing unstable operation and still not producing commutation trouble. The latter symptom of interpole trouble was particularly in evidence, the commutation being practically perfect from full load up to 100 per cent overload despite the unstable operation. Commutation at light loads was not quite so satisfactory as on heavy loads probably because of leakage at and saturation of the interpoles under the latter conditions.

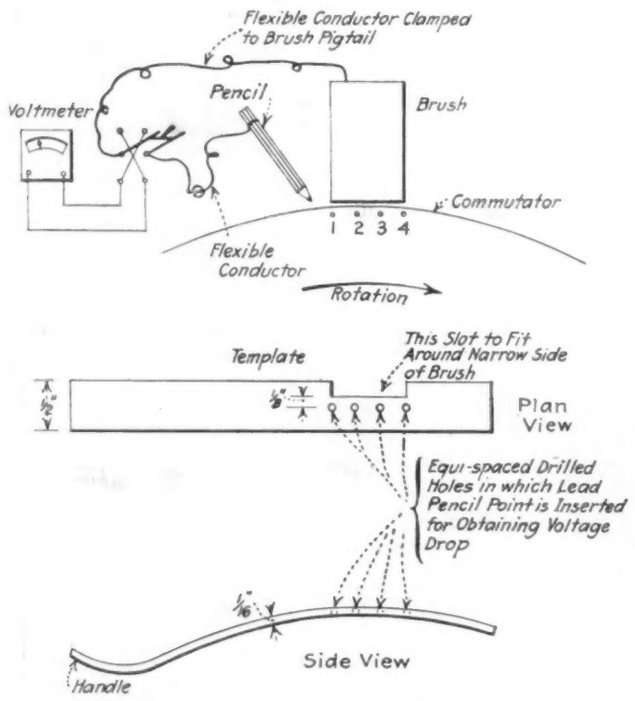


FIG. 1—EQUIPMENT EMPLOYED IN MEASURING BRUSH-VOLTAGE DROP

To corroborate this evidence the voltage drops from the commutator to each brush were read at the heel, toe and intermediate points as follows: After making sure that the commutator was smooth and polished and the brushes were seated over their full width and under normal tension a uniform load was maintained by the pump-back method. This was done on Sunday, when an old engine-driven generator could carry the few necessary pumps and fans. Then a voltmeter with a 5-volt scale, a double-blade, double-throw knife switch and the lead of a hard-lead pencil were connected as shown in Fig. 1. A fiber template slotted and perforated as shown and shaped to conform with the periphery of the commutator was then laid on the commutator so that the slot fitted around a brush. Voltage drops were recorded when the pencil point was inserted in holes 1, 2, 3 and 4. A pencil was considered preferable to a wire point, since the latter would scratch a rotating commutator.

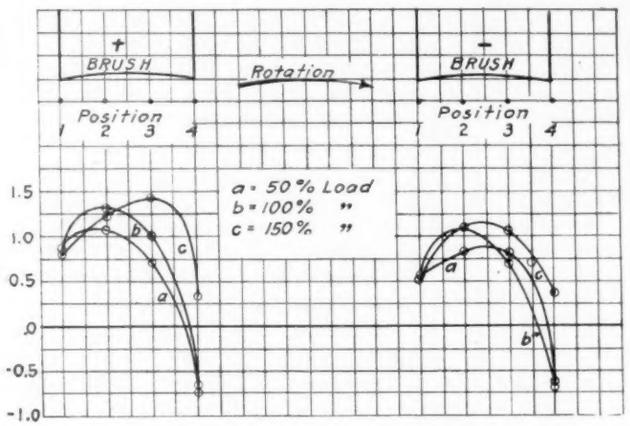


FIG. 2—AVERAGE BRUSH VOLTAGE DROPS BEFORE CHANGING INTERPOLE FIELD STRENGTH

To check the division of current between brush arms, the brush spacing, symmetry of air gap, degree of leakage and interpole saturation brush drops were ascertained on two positive and two negative brush arms (out of a total of six arms) at 50 per cent, 100 per cent and 150 per cent of rated load. With full load and proper compensation the voltage drops at the toe and heel of each brush should be equal although the drops at intermediate points may be slightly greater. It was found, however, as shown by the accompanying data and curves, that the drops on the trailing tips of the brushes were higher than on the leading edges, indicating that the machine was over-compensated. It may be pointed out, however, that the data on difference arms agreed very closely for similar loads, showing that the current was approximately equally divided between brush arms, that the brush spacing was correct and that the air gap was uniform. On the other hand negative readings were obtained at half and full loads on template position No. 4, showing that the leading side of the brush for about one-eighth of its width carried excessive short-circuit current and no useful current. This indicated extreme over-compensation. In any but an extremely liberally-designed machine such a condition is very liable to cause excessive sparking at the brushes.

TABLE I—BRUSH DROPS EXISTING BEFORE AND AFTER ADJUSTING INTERPOLE FIELD STRENGTH. (HEAVY OR BOLD FACE FIGURES INDICATE CONDITIONS AFTER ADJUSTMENT)

Positive Brushes						Negative Brushes					
Load	Br'sh Arm	Test Position 1	2	3	4	Load	Br'sh Arm	Test Position 1	2	3	4
50 per cent.	No. 2	0.9 **1.0**	1.0 **1.2**	0.6 **1.0**	−0.5 **.40**	50 per cent	No. 1	0.5 **.55**	0.9 **.90**	0.6 **.80**	−0.4 **.3**
50 per cent.	No. 6	0.8 **.70**	1.1 **1.1**	0.8 **1.1**	−1.0 **.60**	50 per cent	No. 5	0.6 **.70**	0.7 **1.0**	1.0 **.70**	−1.0 **−.10**
Average.....		0.85 **.85**	1.05 **1.15**	0.70 **1.05**	−0.75 **.50**	Average....		0.55 **.60**	0.8 **.95**	0.8 **.75**	−0.7 **.10**
100 per cent.	No. 2	0.8 **1.3**	1.2 **1.6**	0.8 **1.5**	−0.6 **−.60**	100 per cent	No. 1	0.4 **.90**	1.2 **1.3**	1.0 **1.2**	−0.5 **.80**
100 per cent.	No. 6	0.8 **1.0**	1.4 **1.6**	1.2 **1.8**	−0.8 **1.0**	100 per cent	No. 5	0.7 **.80**	1.0 **1.3**	0.4 **1.3**	−0.8 **.50**
Average.....		0.8 **1.15**	1.3 **1.6**	1.0 **1.65**	−0.7 **.80**	Average....		0.55 **.85**	1.1 **1.3**	0.7 **1.25**	−0.65 **.65**
150 per cent.	No. 2	0.9 **1.0**	1.0 **1.5**	1.3 **1.8**	0.1 **1.4**	150 per cent	No. 1	0.4 **.50**	1.2 **1.20**	1.4 **1.7**	0.3 **1.5**
150 per cent.	No. 6	0.7 **.70**	1.4 **1.4**	1.5 **1.8**	0.6 **1.7**	150 per cent	No. 5	0.6 **.90**	0.9 **1.3**	0.7 **1.4**	0.4 **1.1**
Average.....		0.8 **.85**	1.2 **1.45**	1.4 **1.8**	0.35 **1.55**	Average....		0.5 **.70**	1.05 **1.25**	1.05 **1.55**	0.35 **1.30**

Finding the generator greatly over-compensated, methods of reducing the interpole field strength were considered. Connecting a shunt across the interpole winding was not favored because doing so tends to make a generator more susceptible to flash over on sudden load changes and short-circuits. The alternative, increasing the interpole air gap, was therefore adopted. Accordingly, about two-thirds of the "liners" were removed from between each interpole and the yoke, thereby increasing the air gap approximately 40 per cent. As shown by the curves plotted from test data obtained after this change, the compensation obtained was about correct. While the algebraic differences between voltages drops at trailing and leading brush edges changed with variation in load, the conditions secured were desirable, as shown in subsequent tests, in which no sparking was observed at loads up to 150 per cent of rating, and only fine sparking was noticed at 200 per cent load. Since the two generators were duplicate machines, similar changes were made in each, with equal results.

The reduction in interpole field strength caused a considerable decrease in the compounding, so it was necessary to readjust the shunts across the series fields of each generator. Since these changes have been made

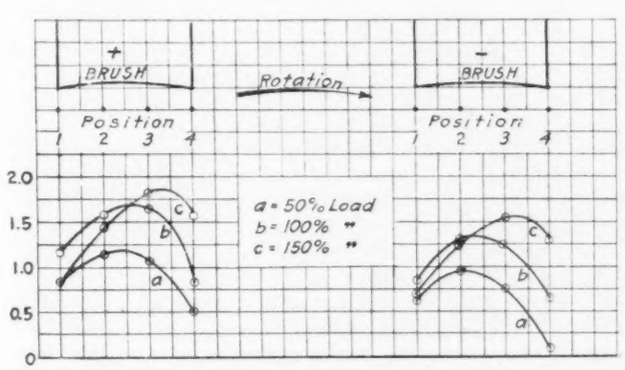


FIG. 3—AVERAGE BRUSH VOLTAGE DROPS AFTER CHANGING INTERPOLE FIELD STRENGTH

the two motor generators have operated satisfactorily in parallel under all load conditions. There has been no tendency for either machine to "motor" the other when the entire load is "dropped" suddenly, and it is seldom necessary to touch either field rheostat during a run.

PERFORMANCE OF BOILERS WITH BALANCED DRAFT

An Analysis of Combustion Conditions and Boiler Operation When Nearly Atmospheric Pressure Is Maintained in the Furnace Chamber

BY R. J. ELKIN

WHILE the steam turbine and the electrical generator have both passed through epoch-making improvements within the last decade, developments in the making of steam—the construction of the furnace and material used in it, the boilers, stokers and the methods of firing, etc.—have hardly kept pace with the prime mover in many respects. Strenuous efforts are continually being made to increase the over-all efficiency of a steam generating unit a fraction of a per cent by reducing the steam consumption or increasing the vacuum a small portion of an inch while the possibility of obtaining a proportional increase in the effective heating value of coal has in most cases gone unminded, or at least does not appear to have received nearly the amount of attention that its importance warrants.

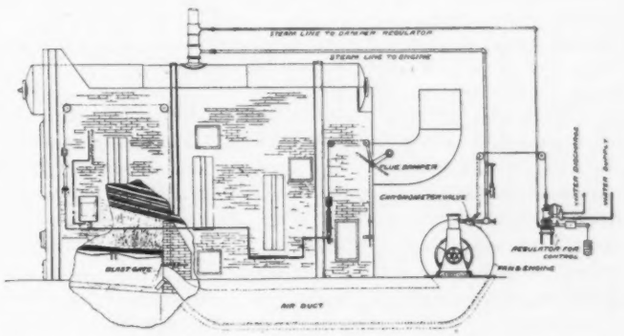


FIG. 1—AN APPLICATION OF BALANCED DRAFT TO A HAND-FIRED BOILER

Under the most favorable circumstances the boiler room is the most wasteful portion of a steam plant, and the one imposing the most serious limitations at the present time in generating stations where enormous amounts of energy are concentrated. In the endeavor to raise the thermal efficiency of the furnace by reducing the large amount of heat lost up the chimney, economizers and superheaters are used for the feed-water and the steam, while mechanical stokers, forced draft, combination oil and coal burners and pulverized coal burners have been used to extend the limitations of the boiler furnace.

In several large steam plants the results secured by a system of balanced draft for the control of boiler furnaces has attracted considerable attention. Higher efficiency, increased capacity during normal and forced rating, and at the same time a lower operating and maintenance expense have been shown. In what follows the operation of the system of balanced draft, and some of the results that have been obtained, are outlined.

For a given rate of combustion the higher the percentage of carbon dioxide contained in the flue gases the higher will be the temperature of these gases, since the more nearly perfect the combustion the greater the amount of heat evolved for a definite weight of coal. Moreover, the temperature of the furnace will increase directly with the increase of carbon dioxide, and likewise the steam pressure, which, of course, depends upon the amount of heat absorbed by the boiler, that is to say, upon the initial temperature of the furnace gases. From this it follows that if the steam pressure, which depends upon boiler temperature, is used as a means of accurately and automatically controlling the supply of

air to the furnace, the rate of this air supply may be maintained at a value such as will give the maximum percentage of carbon dioxide in the flue gases at all times. It is upon this fundamental principle—the control of the furnace as a function of the amount of carbon dioxide in the flue gases—that the system of balanced draft is based.

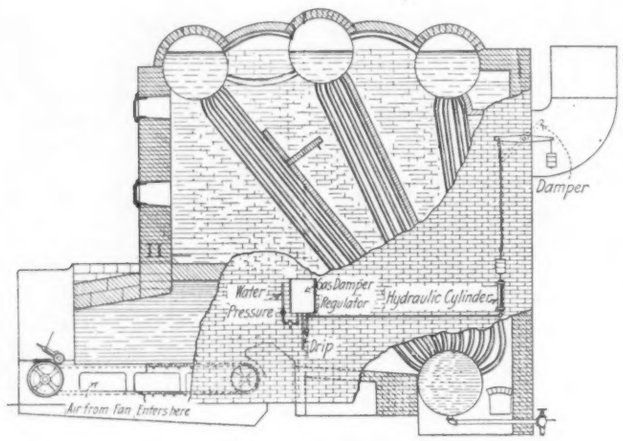


FIG. 2—APPLICATION OF BALANCED DRAFT TO STERLING BOILER WITH CHAIN GRATE STOKER

The term "balanced draft" is understood to mean that a uniform pressure, preferably atmospheric, is maintained in the furnace chamber at the firedoor for all rates of combustion. Usually in practice, however, the pressure of the furnace gases is maintained slightly below that of the atmosphere. There are ordinarily many difficulties in accomplishing this, and it is only possible by accurately controlling the supply of air to the furnace. If the air is drawn through the fuel bed —which necessarily means a pressure considerably less than atmosphere above the grate and combustion chamber—the air supply will be variable and erratic on account of air being drawn in through open or leaky doors, through crevices and cracks in the boiler settings, and the like. In addition to these causes of a changeable air supply, other factors tending to make the supply of air variable are the thickness of the fuel bed (freshly fired coal always tends to more or less diminish the quantity of air passing through the fuel bed, causing the formation of a certain amount of carbon monoxide, while chilling of the fire takes place); atmospheric conditions; the opening and closing of furnace doors, and leakage above the grate. These factors all, either singly or combined, operate to make the supply of air anything but constant, thus precluding the use of natural draft where anything approaching the requisite amount of air is to be obtained.

To enable the maintenance of uniform or atmospheric pressure in the furnace chamber at the firedoor, that is to say, maintaining balanced draft, natural draft cannot be used, but instead a system of forced draft is utilized that will give a constant volume of air at a variable pressure for a given speed of the blower, the pressure being controlled automatically according to the resistance of the fuel bed.

There are several ways in which this may be done. One method consists of a damper controller which automatically changes the position of the boiler damper in unison with the varying speed of the blower that supplies the air to the furnace, the speed of the blower in turn being varied by the steam pressure. Another method, and the more preferable, is by using a gas pressure regulator controlled by the pressure of the gases in the furnace chamber. When a change of gas pressure occurs the damper regulator operates the flue damper in such a way that it counteracts the change in pressure, tending therefore to maintain a uniform pressure in the furnace chamber for all rates of combustion. In this way the excess suction of the chimney beyond that required to remove the gases from the boiler is eliminated, and the chimney has but one function to perform, namely, to remove the gases of combustion from the boiler fires instead of having also to supply air to the furnace. As the entire supply of air is controlled by the power-driven blower, which is, of course, independent of atmospheric conditions, the fire temperatures may be controlled closely with great rapidity.

A general idea of the arrangement of the various equipment necessary for obtaining balanced draft may be obtained from Figs. 1, 2 and 3. Fig. 1 shows balanced draft applied to a hand-fired boiler, Fig. 2 to one using a chain grate stoker, and Fig. 3 shows another arrangement often used. The gas pressure regulator controls both the inlet air damper and the exit flue damper, and the speed of the blower is controlled by a steam pressure regulator.

In analyzing the effect of balanced draft in raising the efficiency and capacity of boilers, it is necessary to consider the matter from several points of view. About 12 lb. of air are required per pound of carbon burned to complete combustion, and since any air in excess of this amount does not combine with the coal in combustion, but merely dilutes and cools the gases, it can be seen that only when this amount of air is obtained does the fire develop its maximum temperature. As a boiler absorbs heat in proportion to the difference of temperature between furnace gases and itself, the higher the temperature of the furnace gases above that of the boiler the more rapid and greater, obviously, will be the absorption of heat by the latter. It is not only in this way that the thermal efficiency of the fuel is raised, however. By eliminating all excess air the volume of gas for any definite weight of coal consumed is reduced to a minimum, and it follows, therefore, that the velocity of these gases in passing from the furnace through the boiler and into the chimney is proportionally reduced. The time during which the gases are in contact with the boiler is an element which affects the heat transfer from gas to boiler, hence it naturally follows that the reduction in the velocity of these gases repre-

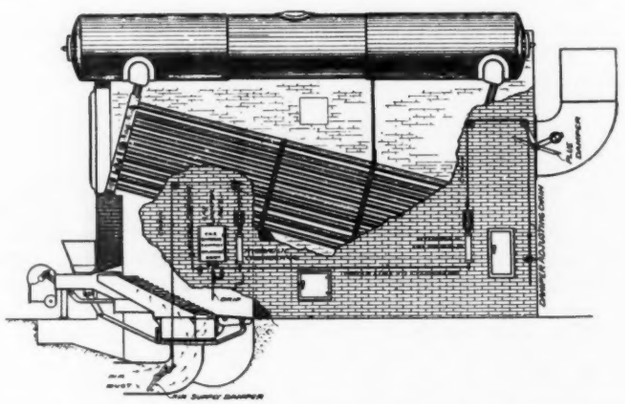


FIG. 3—A METHOD OF AUTOMATIC CONTROL WITH BALANCED DRAFT AS APPLIED TO UNDER-FEED STOKER-FIRED WATER TUBE BOILER

sents a direct gain in the heat absorbing capacity of the boilers, and is somewhat analogous to increasing the heating surface, but without increasing the radiation and conduction losses incident thereto.

In another issue operating results from several installations using balanced draft will be presented together with test data.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Farmer Hired to Charge Nearby Electrolytic Lightning Arresters

M. H. Wagner at the recent convention of the Ohio Electric Light Association expressed the belief that one of the Dayton Power & Light Company's lightning problems has been solved by hiring a farmer living near one of its outdoor substations to charge regularly the electrolytic lightning arresters. By the adoption of this plan the company is able to use what it considers the best equipment for protection against lightning at an isolated substation where the service of a regular attendant could not be afforded. The services of the farmer have been secured at low cost, and his record for dependability leads the company to expect success from the plan.

Rush Installation of 450-Kva. Outdoor Transformer Substation

On Saturday morning, June 17, the contract department of the Georgia Railway & Power Company called on the construction department to install a 450 kva., 22,000/2200-volt transformer substation and run a 2200-volt pole line a distance of about 1 mile so as to make it possible to energize the line on the following Wednesday afternoon. This station was to be built about 45 miles from Atlanta, and transformers and all other material had to be shipped from this point. Two 4-ton trucks were rented and a 150-kva. transformer placed on each, together with all the material necessary for line work and the building of the station. A third transformer was shipped by freight. The trucks reached the station on Saturday afternoon and the third transformer, shipped by freight, arrived on Monday. On Sunday, the poles required to carry the high and low-

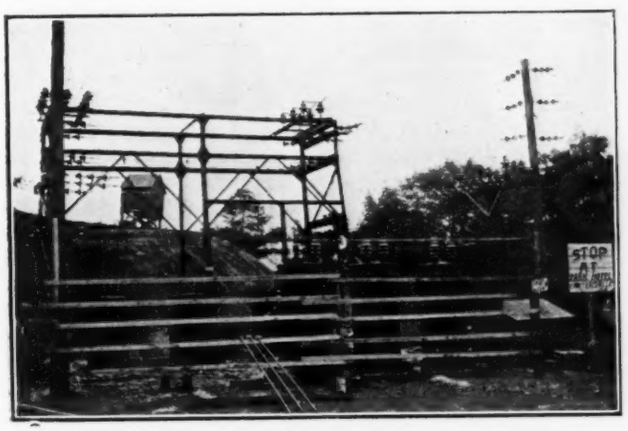


FIG. 1—COMPLETED 450-KVA. SUBSTATION SHOWN IN THE FOREGROUND; A 22,000/550-VOLT STATION IN THE BACKGROUND

tension buses were set and guyed. On Monday the substation crew started work on the station and completed it on Tuesday afternoon. The line crew also started its work on Monday and completed the 1 mile of 2200-volt, three-phase line Wednesday afternoon at 3 o'clock. The transformer substation and the line was energized on Wednesday afternoon, June 21, at 5 o'clock. This work required a foreman, a crew of four men on station work and ten men on line work. E. B. Hook, Jr., superintendent of construction, supervised the work.

The work was completed in this short time in spite of a difficulty encountered. On Tuesday afternoon, while checking the transformer connections, the inspector dis-

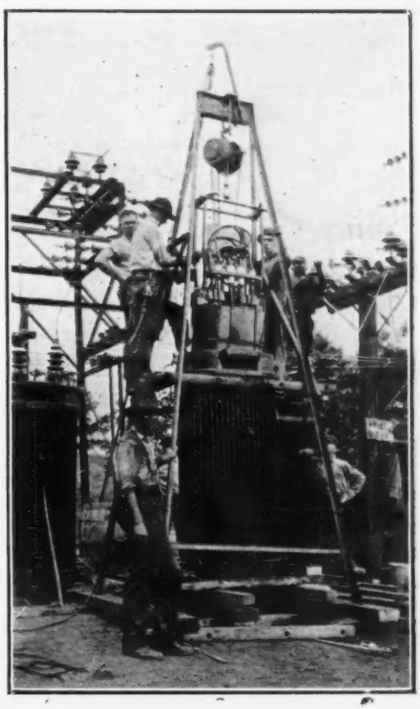


FIG. 2—METHOD OF REMOVING CORE FROM TRANSFORMERS

covered that two nuts from the terminal board of one transformer were missing, and one nut from another transformer. The special frame for lifting transformer cores from their casing was rushed by truck from Atlanta to the substation and the cores removed from the units. In Fig. 2 the device and method used for removing the cores is shown. One nut was found in each transformer, however, and one of the nuts was not found. Therefore one transformer could not be used on account of the danger of the nut being in between the windings, which might cause a short-circuit when the unit was energized. The station was temporarily cut in with two transformers connected in open delta.

Comparisons of British and American Boiler Design and Operation

In a discussion on a paper recently presented before the Incorporated Municipal Electrical Association in London, on problems of boiler-house design and operation, S. L. Pearce of Manchester, England, outlined some of the differences in British and American boiler-room practice noticed during a recent inspection trip in this country. The accompanying table of differences in water-tube boiler design and operation was presented.

The data and information in the third column of the table were given for a new station representative of British practice, with the comment that such data showed how British practice has been more on the safe

DETAILS OF SOME LARGE WATER TUBE BOILERS

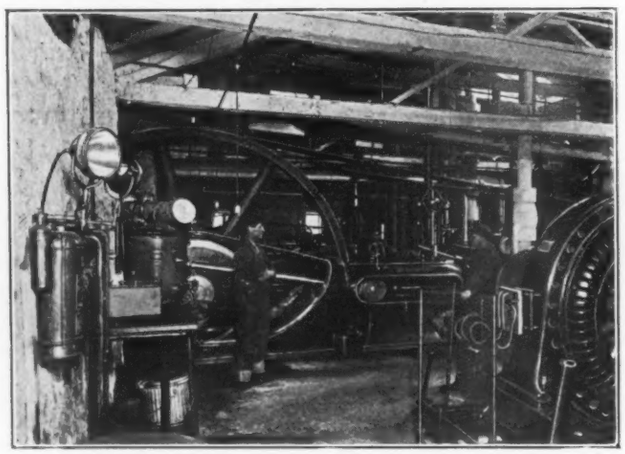
	Detroit	Chicago	Manchester, England
Heating surface in square feet	23,650	12,250	11,000
Economizer surface in square feet	None	8,500	5,000
Superheater surface in square feet	.....	612	3,924
Grate area in square feet	400	274	312
Evaporation in pounds per hour	130,000	70,000	50-60,000
Consumption of fuel per square foot of grate area per hour	.....	45 lb.	21-26 lb.
Gage pressure in pounds per square inch	225	210	225
Superheat	200*	225 deg. F.	275 deg. F.
Diameter of tubes	4 in.	4 in.	3½ in.
Water evaporated per hour per square foot of heating surface	5.64	6.53	4.75
Ratio of heating surface to grate area	59/1	44/1	35/1
Temperature of feed water	.....	250 deg. F.	210 deg. F.

*At 200 per cent rating.

side of operation than in America, in that the boilers were designed for long-continued operation with plenty of margin. The high values credited to American boilers were attributed to results from the use of the underfeed type of mechanical stoker working under forced draft conditions.

Automobile Searchlamps for Station Emergency Lighting

In the power station of the LeRoy (N. Y.) Hydraulic Electric & Gas Company a serviceable and reliable emergency lighting outfit is used which consists of two automobile searchlights operated from a small storage battery. The outfit is mounted as shown in the accompanying illustration. The two searchlights are fastened to home-made brackets and arranged so that they may be turned at any angle and thus light any part of the operating floor of the station. The battery used is



STORAGE-BATTERY OPERATED SEARCHLIGHTS INSTALLED FOR EMERGENCY USE IN SMALL NEW YORK STATION

rated at 6 volts, 13.5 amp., and is shown on the shelf below the lamps. The battery is also wired to the station exciter bus with 110-volt lamps in series so that it can be charged by simply screwing the lamps into the sockets. The searchlights are connected in series to the battery. The entire outfit costs about $30 and, according to D. C. H. Prentice, manager of the company, has given most satisfactory and valuable service during emergency shutdowns, besides overcoming the objection of the Underwriters to the use of oil lamps in such cases.

COST OF OUTDOOR SUBSTATIONS

Net Cost per Kw. of Switching, Fusing, Choke Coil, Lightning Arrester Equipment and Tower Frames

In a discussion at the recent Cedar Point convention of the Ohio Electric Light Association, H. W. Young, president of the Delta-Star Electric Company of Chicago, gave the following data on the cost of outdoor substations. These substations were divided into three classes: (1) The small installation supplying one or more consumers (2) The medium capacity type supplying a group of consumers or small communities. (3) The high-rated type which may serve a single large consumer, a town, or furnish power to a comparatively large territory. The cost per kilowatt of the small station is high when compared to the larger stations. The income from it is also often small and the result is a rather low earning power. The service given by such a small outdoor substation, however, is one which, as a rule, can not be economically undertaken with any other form of equipment, and is essential in developing power loads along transmission lines.

TABLE I—NET COSTS PER KW. OF EQUIPMENT WITH 100 PER CENT OVER-FUSING ON HIGH-TENSION SIDE

Voltage Three-Phase	Size in Kw.	Cost per Kw. in Dollars				
		A	B	C	D	E
13,200	50	$5.00	$6.00	$6.90	$0.022	$3.50
	100	2.32	3.07	3.52	0.0138	1.75
	250	1.00	1.26	1.45	0.008	0.89
	500	0.50	0.66	0.75	0.0053	0.35
	1000	0.28	0.35	0.40	0.0037	0.18
	2000	0.15	0.19	0.21	0.0022	0.12
22,000	50	5.50	7.30	8.20	0.022	3.50
	100	2.75	3.65	4.10	0.011	1.75
	200	1.40	1.86	2.05	0.0069	0.88
	400	0.72	0.95	1.06	0.005	0.44
	800	0.40	0.52	0.57	0.0133	0.22
	1600	0.23	0.27	0.30	0.0024	0.11
	3200	0.14	0.15	0.16	0.0014	0.09
33,000	50	6.00	8.00	9.80	0.022	3.50
	100	3.25	4.25	4.90	0.011	1.75
	200	1.70	2.16	2.50	0.0143	0.88
	500	0.74	0.94	1.07	0.0135	0.35
	1000	0.40	0.50	0.57	0.0039	0.22
	2000	0.21	0.27	0.30	0.003	0.11

As outdoor substations increase in size the cost per kilowatt rapidly decreases. The costs of two installations serve as an example: A 25-kw., single-phase, 22,000-volt, 25-cycle substation with wooden poles and platform construction installed, cost approximately $22 per kilowatt, or $550. This cost includes the following items: Transformer, $13 per kilowatt; switching and protective equipment, $5 per kilowatt; structure material and labor, $4 per kilowatt. A 900-kw., three-phase, 22,000-volt, 25-cycle steel-tower substation installation cost $4,398.18, this being $4.88 per kilowatt, divided as follows: Material cost, including transformers, $4.33 per kilowatt; labor cost, 55 cents per kilowatt. The labor cost on this particular station included hauling the transformers a considerable distance over poor roads, which constituted practically half the total labor cost.

For stations from 50 kw. to 3200 kw. at 13,200, 22,000 and 33,000 volts, three-phase, the costs per kilowatt of the complete high-tension switching, fusing, choke coil and lightning-arrester equipment are given in Table I.

Column A covers the cost of double-break (per phase) three-pole switches and simple horn-gap arresters. Column B gives data for an installation which is the same as A, except that the arresters have limiting resistors in the grounded circuit. Column C presents data for equipment which is the same as A, except that arresters are of the high-speed sphere-gap resistor

type. Column D gives the cost per kilowatt per phase of chemical fuse renewals. The cost per kilowatt of hot galvanized steel tower frames is given in column E. Especial attention is called to the rapid decrease in cost with increase of transformer rating.

Manhole Guards of Compact Design That Protect Against Accident

In the accompanying illustration two types of manhole guards are shown which give adequate protection and yet are compact for transporting and light for handling. These guards are used by the underground cable department of the Commonwealth Edison Company in Chicago. The upright one shown in the photograph is employed in the downtown area or where traffic is heavy. It is made up of four 1¼-in. by 1¼-in. angle bars and 1-in. strap iron, and assembled in three pieces, the two sides and back, which when transporting are packed flat together and occupy very little space. When set up around a manhole opening, the back piece locks with the two side pieces by means of notches in two cross-bars which slip over projecting rivets in the side pieces. On the front edge of each side piece is a bar fastened by one rivet to the vertical angle iron. These two bars, at the top of one side and midpoint of the other, swing across and notch over a rivet on the opposite side piece to form the fourth or front side of the guard.

To enter the manhole, the top one of these bars is dropped temporarily. The four angle irons forming the vertical members of the guard extend into the neck of the manhole, which in every case is square and a standard size, and the lower horizontal bars rest on the iron frame of the manhole. A piece of sheet iron 10 in. wide is placed on each side of the guard at the ground line, and these form a band around the opening to keep the dust from blowing in.

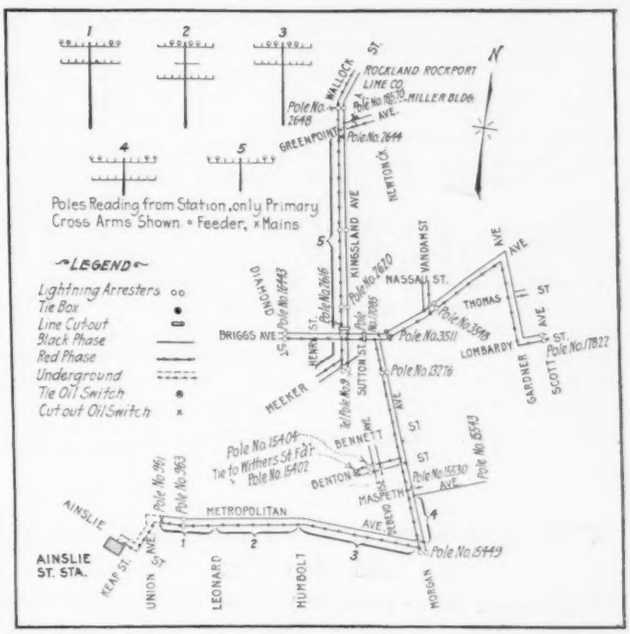
In the outlying districts of the city where there is less traffic, but some protection is needed to keep children from stepping into the opening, a screen cover which rests in the manhole cover seat, as shown in the illustration, is used. While this is light and easy to handle, it is sufficiently rigid to support the weight of heavy auto trucks, as has been demonstrated upon numerous occasions in actual service. These guards are made of 1½-in. by ½-in. channel irons and 3/16-in. steel-wire screens with 1¼-in. mesh.

TWO TYPES OF MANHOLE GUARDS USED BY CHICAGO COMPANY

Identification Record for Overhead Primary Circuits

BY R. A. PAINE, JR.

When several primary feeders are supported on the same pole some companies identify the circuits by placing marks on the crossarms. This is costly, however, and apt to lead to serious mistakes, especially where circuits are being continually rearranged. The Edison Electric Illuminating Company of Brooklyn employs an identification system which does not possess either of these objections. It consists of indicating on each primary-feeder map the crossarms and pins on which each circuit is supported. Before a change is made the print is prepared and as soon as the construction has been completed revised prints are issued thereby keeping the records up to date.



PRIMARY MAP SHOWING POSITIONS OF CIRCUITS ON CROSSARMS

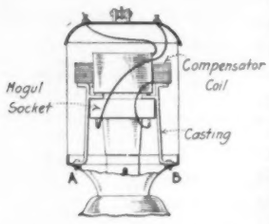
Each phase is represented by a single line, different legends being used to distinguish between phases. The positions of the circuits on the cross arms are indicated by small circles over the corresponding pins. Only crossarms carrying primary feeders or mains are indicated on the maps, others being represented by a short dash across the pole. The dash also indicates an empty gain. The portions of the feeders to which any pole section refers are shown by dimension lines numbered to correspond with the proper pole. This has been found of considerable value as a check on the memory of the linemen and especially when they are shifted from one district to another or in emergency cases.

Old Arc Lamps Make Inexpensive Incandescent Street Lamp Fixtures

The city water and lighting department of the city of Lincoln, Neb., has been able to effect a net saving of $570 by utilizing 100 old arc lamps in the construction of nitrogen lamp fixtures for its street lighting circuits. In commenting upon the situation Paul W. Doerr, assistant superintendent of the water and light department, said: "We found that the best price for new nitrogen lamp fixtures complete was $11.50, while rebuilding the old arc lamps cost $6.70 each, including the cost of

installing a mogul screw socket and compensator coil in the casing, and finishing the unit. The old junk copper coils taken from the arc lamp netted 95 cents each, making the net cost of each unit $5.80 apiece."

The compensator installed, as shown in the sketch, was furnished by the George Cutter Company of South Bend, Ind. The scheme of mounting the mogul screw socket and the compensator coil on the casing of an old lamp is also shown. Two castings were required to hold both the sockets and the coil, and these castings were arranged so that they could be fastened directly to the lower brass casing of the lamp by means of small screws. The holes for these screws at *A* and *B* were already drilled and tapped in the brass casing. The work of making the change included the assembling of the coil and socket on the mounting legs and then fastening the assembled parts into the casing by means of the screws at *A* and *B*. The compensator and the socket were then wired to the arc lamp binding posts. The short circuiting switch in the top of the former arc lamp was not included in the circuit. The entire fixture was given a coat of black enamel and the underside of the reflector treated with a coat of white baked enamel paint.



MOUNTING FOR COMPENSATOR COIL IN OLD ARC LAMP CASING

Cost of Operating Motors in Lime Plants and Quarries

In a recent paper presented before the National Lime Manufacturers Association, R. D. Donaldson, power engineer, The United Gas & Improvement Company, Philadelphia, Pa., gave operating data and costs for motor drives in several lime plants and quarries. He called attention to the fact that although it is generally believed the application of an electric motor to a steam hoist requires either a direct-current motor or some type of variable speed alternating-current motor, experience has shown that this is unnecessary, for the constant speed alternating-current motor can be applied to practically all steam hoists. A complete new crankshaft for an existing steam-driven hoist and the necessary gears to reduce the speed as low as possible is all that is required. In regard to hoisting with an electric motor, one case was cited where approximately 3000 tons of stone per month was hoisted up an incline with a total lift of approximately 115 ft. at a cost of $11.50 with current at 2 cents per kilowatt-hour.

The energy consumption of a stone crushing plant running fairly steadily and turning out 3000 tons of crushed and screened stone per month was given as 1 to 1.1 kw.-hr. per ton. A plant running fairly steadily and turning out 12,000 tons of crushed stone per month consumes between 0.8 and 1 kw.-hr. per ton of product. The idle load of a crusher plant is very large. The power required to keep the crusher plant running up to speed approximates 50 per cent of the total power required to crush the maximum quantity of stone. By good routing of cars, however, or by any other means which will keep the operation of the crusher plant up to its maximum output, the power consumption per ton of stone crushed can be reduced from 30 per cent to 40 per cent from the consumption figures given.

In the majority of cases, it was pointed out, the cost of coal consumed for the operation of the steam plant is less than the cost of the equivalent electrical energy. However, the labor charges, repairs supplies and oil all tend to make it possible to operate electric motors and under average conditions with purchased energy the operation is enough cheaper than private plant operation to warrant the investment required to utilize electrical energy.

The following data show the investment cost for electrifying and operating different lime plants.

COST OF EQUIPPING AND OPERATING LIME PLANTS

Plant Number	Number of Kilns	Tons Output for 24 Hours	Cost of Equipment	Cost of Energy at 2 Cents per Kilowatt-Hour	Cost of Steam Operation	Annual Saving
1	5	65	$5,000	$4,000	$6,500	$2,500
2	4	48	2,500	2,400	4,800	2,400
3	16	200	1,500	12,500	19,500	7,000

These plants operate the following equipment:

Plant No. 1—Two 200 g.p.m. centrifugal pumps, blower fan, two hoists, 50-hp. crusher, fan, hammer mill, bagger, rotary mixer, Broughton mixer, hair picker and water supply pump.

Plant No. 2—Kiln blower, two hoists, one 300-gal. centrifugal pump.

Plant No. 3—A 150-hp. crusher plant, dust mill, hammer mill, two complete hydrating plants, Broughton mixer, bag cleaner, 5-hp. quarry pump, small machine shop, hair picker, elevator, two kiln blowers, 30-hp. air compressor for quarry drills. The total installed horsepower for this plant was 650.

Hold-Off Tag Used by Binghamton (N. Y.) Company

Whenever conditions require the holding open of oil switches in the Binghamton Light, Heat & Power Company's stations, printed red cards like the one illustrated herewith must be filled out and attached thereto. On the cards must be written the name of the person ordering the switch opened, the date, the time at which this was done, the reason for the interruption, the purpose of the circuit and any remarks pertinent to the hold-off order. Before the switch may be closed the person ordering it opened must sign the card or order it signed and the name of the person closing the switch must be recorded, with the time. A detailed report of the reason for holding the switch open is recorded on the back of the card after the matter has been attended to. This information serves to locate the responsibility for closing any switch after it has been held off and also gives a record of the reasons for interruption to service on each circuit. The latter purpose alone has justified the card, according to George H. Ives, engineer of the plant, since the parent company is continually asking for this information.

Circuit.....

Date.....

Switch opened by.....

Switch closed by.....

Circuit ordered off by.....

Circuit ordered on by.....

Cause of interruption.....

.....

Breaker blew.....

Other remarks.....

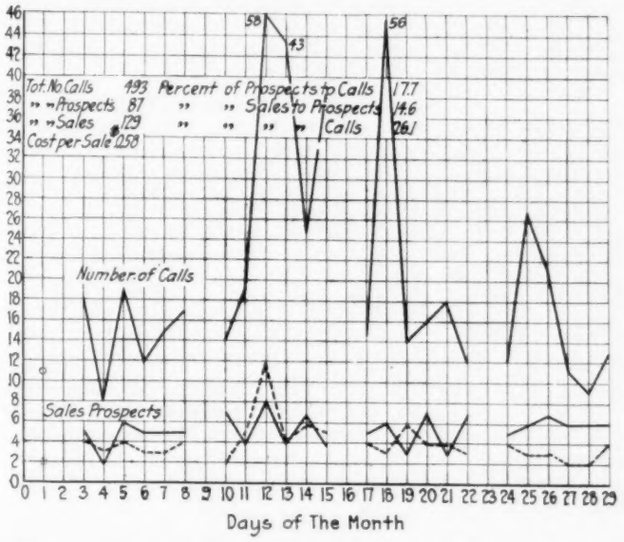
INFORMATION REQUIRED WHEN HOLDING OIL SWITCHES OPEN

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

Curves That Plot the Performance and Efficiency of the Salesman

The Elmira Water, Light & Railroad Company of Elmira, N. Y., employs a graphical method for following the work of its salesmen. As explained by F. H. Hill, general manager of the company, the salesmen's efforts are reduced to a curve, a sample of which is reproduced herewith.


Tot. No Calls 493 Percent of Prospects to Calls 17.7
" " Prospects 87 " " Sales to Prospects 14.6
" " Sales 129 " " " " Calls 26.1
Cost per Sale 1.58
58
43
56
Number of Calls
Sales Prospects
Days of The Month

THE RECORD OF EACH SALESMAN FOR THE ELMIRA (N. Y.) LIGHT COMPANY IS PLOTTED EVERY MONTH IN THIS GRAPHIC FORM

This particular salesman, it will be noted, is an extremely active man, making a very large number of calls per day during the month for which the curve was compiled. The percentage of his sales and his calls, however, is also quite high, and the cost per sale is extremely low. By the word "sale" is meant the securing of a meter contract. The man whose work is indicated on the curve sheet is exclusively on residence work.

At the end of each month each salesman's report is made up on this form and each salesman is given a copy, not only of his own but of every other man's record. "We find," comments Mr. Hill, "that each salesman spends more time in studying the other man's record than he does his own, endeavoring to find out how his competitor does it."

THE SMALL ELECTRIC OFFICE

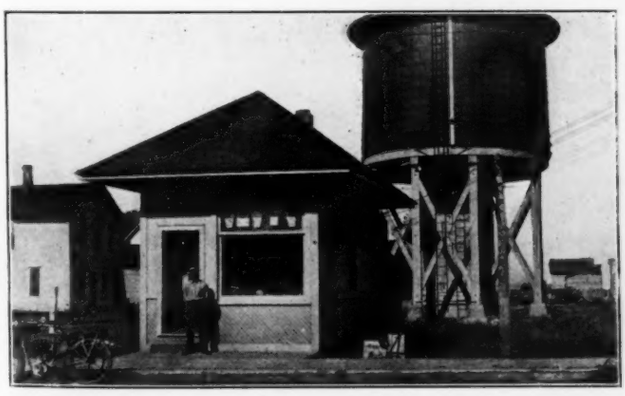
Structures Providing for Showroom, Cashier's Desk, Storeroom and Switching Center, Standardized by Central Illinois Utilities Company

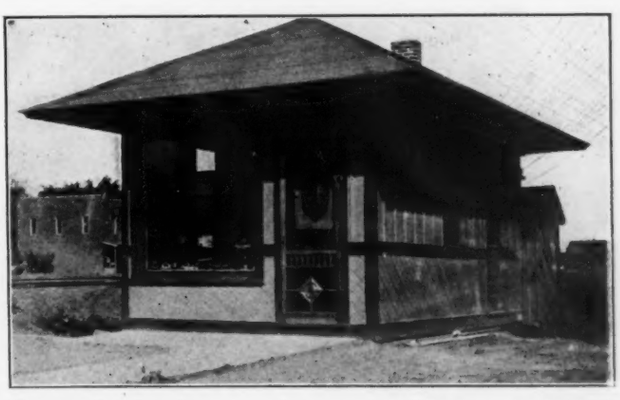
Along with the developments in centralizing electricity supply for small cities in Illinois, there has come a trend toward neater, more convenient and more inviting central-station offices. Thought has been given and is being given to the problem of providing "electric-light offices" which shall more appropriately meet the needs of the small communities. Attempts have been made to analyze the functions to be performed by such offices, and then either to build to suit conditions or to remodel existing structures to make them more nearly fulfill the needs of customers and utility company.

THE SMALLEST COMPLETE CENTRAL STATION OFFICE

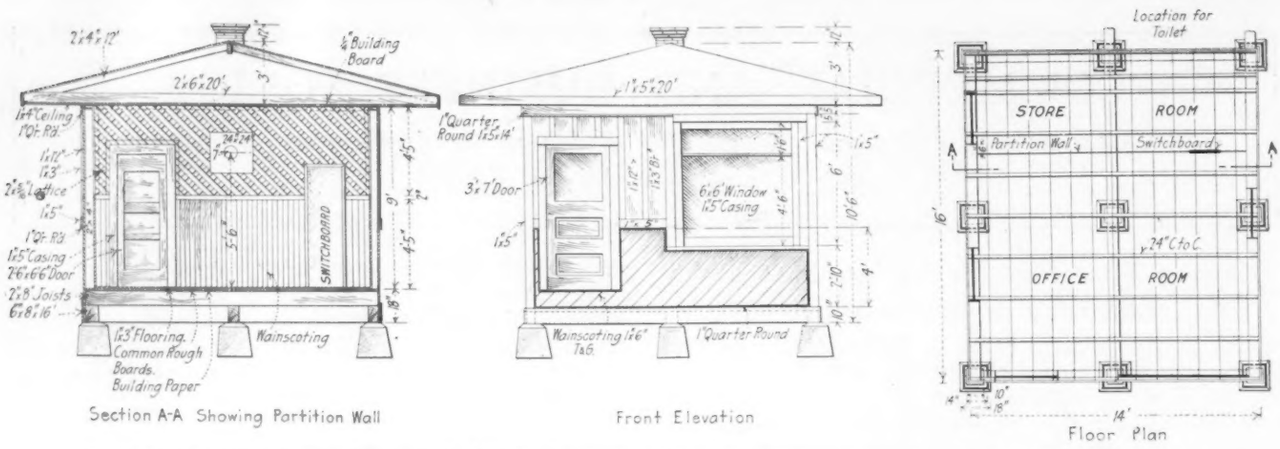
In Piper City, a place having barely 650 inhabitants, the Central Illinois Utilities Company desired an office from which its one local employee could handle its business. This office had to be a place in which customers could pay bills, buy electrical devices and fittings, and contract for electric service and house-wiring. Space had to be provided to store a small stock of electrical goods and workmen's tools, and to set a switchboard which would control the entire distribution system of the town, energy for which is supplied from a transmission line. The problem was solved by leasing at a cost of $10 a year a small plat of ground which was part of the right-of-way of the steam railroad running through the center of the little city, and erecting on this land a 14-ft. by 16-ft. frame structure at a cost, exclusive of equipment, of $380.

The Piper structure and the duplicate of it which was built at Gilman are probably the smallest complete cen-





THE PIPER CITY (ILL.) ELECTRIC-LIGHT OFFICE AND ITS COUNTERPART AT GILMAN, ILL. BUILDING PLANS FOR THESE STANDARDIZED SMALL STRUCTURES ARE REPRODUCED ON THE NEXT PAGE



BUILDING PLANS FOR THE PIPER CITY (ILL.) STANDARD OFFICE STRUCTURE PICTURED ON THE PRECEDING PAGE

tral-station offices in the country. That the Piper office, for example, is complete and that it provides adequate facilities for meeting the demands of the town's 196 electric-service customers and for handling the $7,070.13 of revenue which in one year has passed over its counter, may be seen from the sketch and photograph.

Almost the entire front of this miniature structure is occupied by the door and the show windows. The window is a very important part of the building, for it has been a factor in making the merchandise sales mount to an annual total of $1,453.93—an average of more than $7 per customer. The interior of the office is divided into two parts by a latticed partition, the office part proper measuring 11 ft. by 14 ft., and the back room, which is a store room and a wiring compartment for the 2300-volt lines to and from the oil-switch, measuring 5 ft. by 14 ft. The office is equipped with a roll-top desk, private telephone and city telephone, a table and chairs, and a stove. The operating handle of the oil-switch, as well as the voltmeter, ammeter and watt-hour meter on the swithboard, are all within easy view and reach of the man in charge when he is sitting at his desk. Some of the stock is kept on shelves in the back room, but the larger packages, such as lamp boxes, are kept in the attic above the office. This storage space can be reached by standing on a stepladder and reaching through a manhole in the ceiling of the storage room.

By adopting this solution of its office problems in this small town the company has been able to secure an entirely satisfactory headquarters at a lower cost than it could rent one for. It has secured a desirable central office location and has eliminated the necessity of carrying its primary lines, which had to go to the oil switch, into a more or less inaccessible building further from its transformer substation.

Milford, Ill., another town of 1316 inhabitants on the lines of the same company, was receiving electric service before it was acquired by the Central Illinois Utilities Company. Its office, store and substation as it looked at the time of purchase are shown below. The same building a year or so later, after a little thought and about $100 had been expended in putting it into shape, is shown at the right. This remarkable change in exterior appearance cost only a small part of the $100, since nothing was done but to apply some paint and make an old door into a show window.

The office furnishings had previously consisted principally of an old stove, some stock piled in a corner, a table, and a slatted window through which customers shoved money for their bills. In the process of remodeling, the stove was blacked, the stock was removed from the corner it had occupied to a partitioned and shelved storeroom built in the substation part of the building, and the office and substation were separated by a partition, which was painted. The barred window before the cashier's cage was abolished. The office proper was divided into two parts by a low wooden railing, and some other provisions were made to give increased convenience to the 280 customers who paid the company a total of $10,105.53 in one year for electricity and for merchandise. During the same year the merchandise sales in the town amounted to $948.38.

The simple yet effective solution of the office problem at Milford is considered satisfactory, since it permitted the company to utilize to the best possible advantage what it had available, and to provide a really attractive office in a good location at a nominal cost.

WITH A LITTLE PAINT AND PLANNING AND THE EXPENDITURE OF LESS THAN $100, AN UNATTRACTIVE SUBSTATION BUILDING AT MILFORD, ILL., WAS CONVERTED INTO A LIGHT AND CHEERY CENTRAL STATION HEADQUARTERS

The Importance of Training the Range User in Right Cooking Methods from the Outset

Two next-door neighbors at Corpus Christi, Tex., were each sold an electric range on thirty days' trial. After the ranges had been installed, both housewives were carefully instructed in their use by representatives of the Corpus Christi Electric Company, for which J. A. Dupree is in charge of appliance sales.

Every effort was made to demonstrate to the housewives the most economical methods of operating the ranges. Both users were enthusiastic over the way cooking could be done on the electric range, and prided themselves on the perfection achieved in making fruit cake, roasting turkey, etc. Both employed servants to do the cooking, but one housewife gave her personal attention to the preparation of all meals. These respective servants were both Mexican girls. This, in passing, is of particular interest in the Southwest, comments Mr. Dupree, for the reason that some have been doubtful of the possibility of training such servants to operate electric ranges efficiently.

"We found, in watching these installations," continues Mr. Dupree, "that after the food was removed from the range, in one household the residual heat was utilized for heating water for dishwashing, whereas in the other case a kettle of water was kept boiling on the range at all times during any cooking operation. Attention was tactfully called to this, and the method of making use of the residual heat was suggested, but, notwithstanding, at the expiration of thirty days the meter reading in one case was 345 kw.hr., while the other meter for the same period read 131 kw.hr., although both ranges were of the same make and size.

"Needless to state, the customer whose energy consumption was the lower, accepted his range and sent his check covering its purchase price, and the cost of current used, expressing himself as being well satisfied. The other man, however, wrote a letter asking us to remove the range, stating that they could not keep it because the current consumption was too great; outside of that his family thought the stove was 'very nice.' We then offered to extend his trial for another thirty days, with the services of our demonstrator, explaining that considerable current had undoubtedly been used in becoming acquainted with the working of the range, and that cooking with electricity was by no means extravagant when the range was properly operated. He replied that no amount of argument could convince him that elecricity was a practical fuel, and that if he or his wife should have to watch the cooking and resort to all sorts of devices to economize current, the electric range would cease to be a convenience and defeated the very object for which it was installed.

"Such cases," declared Mr. Dupree, "are exceptional, for in most instances users of electric ranges are willing and eager to follow instructions enabling them to produce the best results with the minimum amount of current consumption." The incident illustrates, however, the importance of starting the new electric-range customer aright, and of demonstrating the ease and convenience of the very simple and sensible economies desirable in the electric kitchen.

Employees' Club's Educational Classes

The Advancement Club of the Red River Power Company, one of the Northern States Power Company subsidiaries located at Grand Forks, N. D., has organized a class for electrical work composed of twelve employees which will be taught by Mr. Radsliff, chief engineer of the company. Each member furnishes his own books.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

A TRIAL CONCENTRIC-WIRING INSTALLATION AT CHICAGO

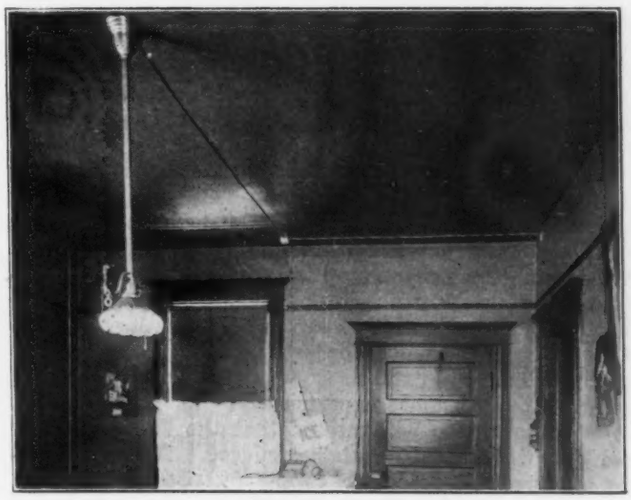
Some Details of the Equipment Just Installed in a Small Frame "Two-Flat" Building, by the Commonwealth Edison Company

An experimental installation of concentric wiring has been made by the Commonwealth Edison Company in the modest frame "two-flat" building at 3424 North Troy Street, Chicago. It may be stated at the outset that the men in the Commonwealth Edison Company who have made a study of the subject have no expectation that the simpler methods of interior wiring will revolutionize existing practice. It seems to be likely that the simple concentric wiring with exposed circuits will be used for only a particular class of buildings, such, perhaps, as small houses, or old houses where the cost of wiring must be moderate if electricity is to be used at all.

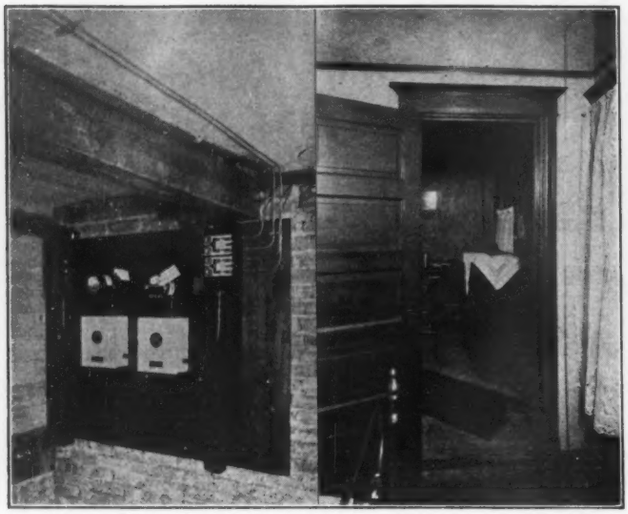
The building selected for the experiment belongs to the Commonwealth Edison Company, having been acquired with some other property, and had never been wired. It contains two flats, one above the other, and a basement. Each flat consists of an entrance hall or vestibule, a living room, two bedrooms, a kitchen, a pantry and a bathroom. The construction department of the company did the wiring, and special permission was obtained from the Department of Gas & Electricity of the city of Chicago.

The building has been wired for a total of twenty lighting and two wall-switch outlets for twenty-four lamps. Complying with the city's requirements, two circuits for each flat were installed. This is based on the rule that the wiring shall provide a capacity for 0.75 watt per square foot of floor space.

Each of the flats was wired for seven ceiling outlets, one baseboard outlet, one wall outlet and one wall-switch. The total number of lamps in each flat is eleven. There are two outlets and two lamps in the



CONCENTRIC WIRING IN ONE OF THE KITCHENS, SHOWING BRANCH AND WALL OUTLET FOR ELECTRIC IRON—PHOTO BY COURTESY OF COMMONWEALTH EDISON COMPANY.



AT LEFT—SERVICE ENTRANCE, METERS AND CONCENTRIC-WIRE CIRCUITS FOR THE TWO TENANTS. AT RIGHT—CIRCUITS PASSING THROUGH BEDROOM FROM BASEMENT

CONCENTRIC CONSTRUCTION IN LIVING ROOM, SHOWING WALL-SWITCH CONTROL OF CEILING FIXTURE. PHOTOS BY COURTESY OF COMMONWEALTH EDISON COMPANY

basement. Distribution of outlets, switches and lamps for each meter was made according to the following table:

Location	Ceiling Outlets	Baseboard Outlets	Wall Outlets	Wall Switches	Number of Lamps
Hall	1-1				1
Parlor	1-3	1-1		1	4
Front bedroom	1-1				1
Rear bedroom	1-1				1
Kitchen	1-1		1-1		2
Pantry	1-1				1
Bathroom	1-1				1
Basement	1-1				1
Total	8	1	1	1	12

The cost of the material used for this wiring job was as follows:

Material (concentric)	$28.23
Material (standard)	3.18
Material (service)	7.49
	$38.90

The labor used on this job amounted to eighty-three and one-half hours—thirty-three hours wireman's time and fifty and one-half hours helper's time.

The cost of the fixtures used was $39.86, the remaining item of cost being 84 cents for carfare and expenses. The amount of concentric wire used was 345 ft.

It was found that the job had cost more than would have been the case if the wiring had been done under the present practice, using flexible metallic conduit and armored cable. The same job was figured on this basis, and the material came to $24.73, with sixty-six hours of labor, divided into thirty-three hours of the wireman's time and thirty-three hours of the helper's time. The fixtures and the carfare and miscellaneous expense would be practically the same in both cases.

It is not thought strange that the first interior wiring job using the concentric wiring method should cost more than the older and well-established method. The cost of concentric wiring is bound to decrease after the wiremen become more familiar with the use of concentric materials. Further, it is evident that where a number of completed buildings are to be wired, larger quantities of material will be ordered, and naturally a better price for material will be secured in view of the quantity required. With more experience in this class of work, it is of course to be expected that the hours of labor per job will be substantially reduced. Again, as will be observed by reference to the pictures, the quality of fixtures used is rather better than might be expected in an installation of this character. The cost of the fixtures has nothing to do with the comparative cost, however, for the same amount is given in each case; but the use of simpler fixtures would reduce the absolute cost. One man who has given considerable attention to the subject believes that when large quantities are used the cost of concentric material will be reduced at least 25 per cent below the present figure, while he thinks that when the workmen get accustomed to handling the concentric wire the labor cost will be about one-third of the labor cost on the experimental installation.

Explaining Lamp-Renewal Schedules to the Customer

Through the pages of a booklet—"Lamps and Lamp Service"—the United Electric Light & Power Company of New York City is telling its customers how best to avail themselves of the company's lamp service. Information is given concerning the kinds and sizes of lamps furnished and renewed free, and a price list of the various types illustrates the saving in lamp costs the customer can obtain if he signs a lamp agreement.

The booklet emphasizes the importance of buying lamps of the correct voltage in order that customers may receive the maximum light at the least expense. The company's rate for lighting service is 8 cents per kilowatt-hour, and with free lamp service the rate is increased 0.5 cent per kilowatt-hour. The why and wherefore of this additional charge is clearly shown in the booklet.

Richmond, Ind., to Have White-Way Lighting

The city of Richmond, Ind., is installing a 120-post "white-way" system. The cast-iron posts used are of the type made by George L. Mesker of Evansville, Ind., and each will be surmounted by a 1000-watt type C lamp in a Novolux fixture. The units will be spaced on 87.5-ft. centers opposite each other on both sides of the street. The series distributing circuits will be operated at 6000 volts, 6.6 amp., and each lamp will be served from these circuits through a series multiple transformer. It will be necessary to lay all of the cable under pavement. The entire cost of the job, according to the Kokomo (Ind.) Electric Construction Company, which has contracted to do the work, will be $15,000.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

DIRECT-CURRENT vs. ALTERNATING-CURRENT FOR CABLE TESTING

The Effect of High Continuous Voltages on Air, Oil and Solid Insulators—Comparisons with Alternating-Current Test Results

THERE is considerable difficulty in practice in making alternating-current voltage tests on long lengths of cables, due to the size of the apparatus, which is necessarily large on account of the charging current. The necessary kilovolt-amperes often amount to several hundred, and the apparatus is difficult to move about, etc. For these reasons it has been suggested to use direct-current for cable testing, since this would eliminate many difficulties. The apparatus required is much smaller than for alternating-current work. The question arises however: To what extent is a given direct-current voltage equivalent to a given alternating-current voltage in its effect on insulators? A paper by F. W. PEEK, JR., presented at the Cleveland meeting of the American Institute of Electrical Engineers, gives a practical answer to this question.

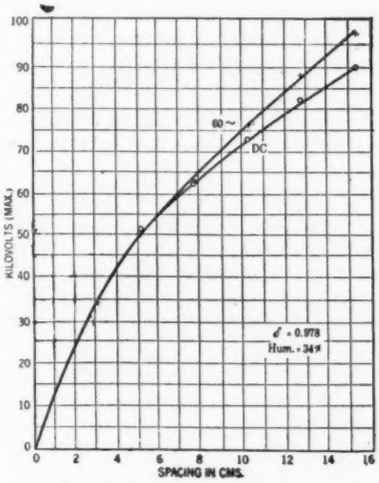


FIG. 1—SPARK-OVER OF 2/0 NEEDLES IN AIR

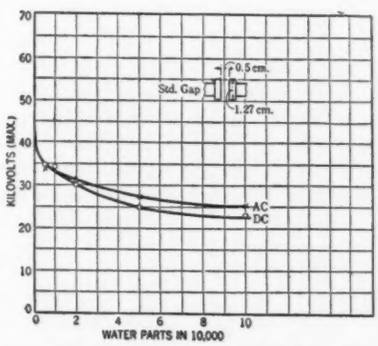


FIG. 2—EFFECT OF MOISTURE ON DISRUPTIVE STRENGTH OF NO. 8 TRANSIT OIL AT 25 DEG. C.

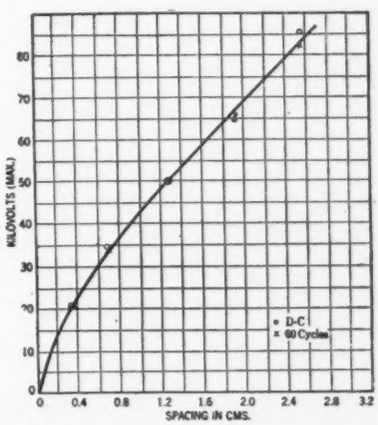


FIG. 3—A-C AND D-C SPARK-OVER VOLTAGES OF 2/0 NEEDLES IN NO. 8 TRANSIT OIL AT 25 DEG. C.

Mr. Peek's paper is an account of a systematic investigation in which the dielectric strength of air, oil and solid insulations was determined for direct-current voltages up to 150 kv. It is interesting to note that the high continuous or direct-current voltages were obtained by means of a kenotron rectifier. The principal results of these tests are as follows:

The direct-current visual corona voltage is equal to the maximum alternating-current corona voltage for wires varying in radius from 0.013 cm. to the largest sizes. The variation of direct-current and alternating-current corona voltages with air density is the same over a large range. The laws for alternating-current voltages apply equally well for direct-current voltages in terms of maximum values.

The spark-over of gaps is the same on alternating-current and direct-current for equal maximum voltages when the gap is such that the spark-over precedes the corona. Thus, for the sphere gap the same laws apply for alternating-current or direct-current voltages. This is true at various air densities.

The direct-current needle-gap spark-over voltage corresponds approximately to the maximum alternating-current spark-over voltage over a considerable range. At the higher values the continuous spark-over voltage seems to be less than the maximum alternating-current values. The results are plotted in Fig. 1.

When corona precedes spark-over there is generally a difference in alternating-current and direct-current spark-over voltages. For a non-symmetrical gap, spark-over at normal air density takes place at the lowest voltage when the electrode surrounded by the denser field is positive. At low air densities spark-over takes place when the electrode surrounded by the denser field is negative. Insulators spark-over at the lowest voltage when the cap, or electrode surrounded by the denser field, is positive. The positive spark-over voltage generally corresponds closely to the maximum alternating-current spark-over voltage.

The direct-current spark-over voltages in oil generally correspond closely to the maximum alternating-current spark-over voltages. In wet oil the direct-current spark-over voltage is lower than the alternating-current. Fig. 3 gives the curve of alternating-current and direct-current spark-over voltages of needles in No. 8 transit oil at 25 deg. C., the direct-current voltages corresponding to the alternating-current maximum. Fig. 2 shows the effect of moisture on disruptive strength of No. 8 transit oil at 25 deg. C., showing the direct-current breakdown voltage to be lower than the alternating-current breakdown voltage. This is probably due to lining up of water particles under direct-current.

The direct-current breakdown voltages of solid insulation, in good condition, are generally higher than the maximum alternating-current voltages. This is especially so when the time of application is long and the insulation is thick. The direct-current breakdown voltage on insulations apparently increases directly with the thickness, while the alternating-current breakdown volt-

age increases at a lesser rate. When the insulation is moist, the direct-current and maximum alternating-current breakdown voltages are generally approximately the same.

To come back to the question raised in the introduction it may be stated that a given direct-current voltage cannot be said to be always equivalent to a given alternating-current voltage in its effect on insulation, yet Mr. Peek's tests indicate that faulty sections of cable could be as equally well located by direct-current tests as by alternating-current tests. In cases of cracks, etc., the air- or compound-filled space would be broken down at the same maximum voltage on direct-current or alternating-current. In case of a fault due to moisture the breakdown would apparently take place at about the same voltage with alternating-current or direct-current. In the case of a cable in good condition there would be much less likelihood of injury by direct-current than by alternating-current of the same maximum voltage. A direct-current voltage equal to the maximum of the alternating-current test voltage would, therefore, seem suitable for such tests.

Generation, Transmission and Distribution

Electricity Supply in Glasgow and Scotland.—W. W. LACKIE.—An abstract of Mr. Lackie's presidential address, before the Institution of Engineers and Shipbuilders in Glasgow. The author sketches the supply of electrical energy and its progress during the last eighteen years with special reference to the electricity supply in Glasgow. The plant of Port Dundas at first consisted of reciprocating engines and dynamos of approximately 1000 hp. each. Five such sets and the necessary water-tube boilers were installed. Later two sets of 2000 hp. each were added. In 1906 three turbo-alternators of 4000 hp. each were installed, and later two turbines of 5300 hp. each. This was followed by a 9000-hp. turbo-alternator in 1914. The total power now in Port Dundas amounts to 28,000 kw., or 37,000 hp. Similar plant has been installed at St. Andrew's Cross, and the total power there is now 17,000 kw. or 22,500 hp. A new generating station is now under construction at Dalmarnock. The chief improvements in the boiler house have been the increase in size of the steam unit, the raising of the steam pressure, and the use of highly superheated steam. The improvement that has taken place in coal consumption in the Glasgow stations, due to larger generating sets, and the introduction of the steam turbine, is shown in Fig. 4. The development of turbo-alternators is next dealt with and the author then takes up the equipment of the new generating station to be erected at Dalmarnock. Novel features in this station are as follows: The auxiliaries are all driven with three-phase alternating-current motors, the energy for these motors being obtained from separate three-phase turbo-alternators, the exhaust of which will be used to heat up the condenser from the main turbines. This means that the condenser from the main turbine is to be used as the circulating water for the condensers of the auxiliary plant. The exhaust steam from the auxiliary turbines will raise the temperature of the condenser as circulating water from 80 deg. Fahr. to 140 deg. Fahr., after which it will be passed to the hot well, and later through an economizer. As the load on the auxiliary turbine, however, is likely to remain fairly constant, while the load, and therefore the condensate, from the main turbine will vary, the condenser of the auxiliary turbine will have a second set of tubes, through which river water can be circulated. The amount of river water will be automatically regulated by the amount of the condensate coming from the main turbine. The other features of the new station will be the size of the boiler units, high superheat, an economizer for each boiler, large coal storage and, consequently, a very complete system of coal handling plant. The author finally takes up the electricity supply in Scotland in general and points out that from the point of view of size of station there is no reason whatever why the whole of Scotland should not be supplied from two or, at the most, three central power stations. The present maximum demand

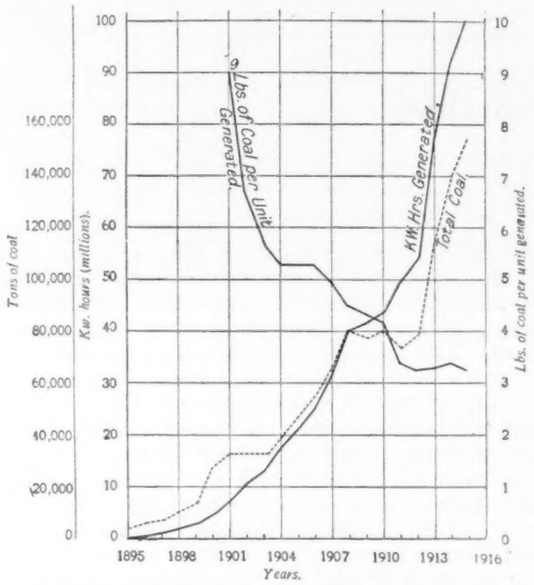


FIG. 4—KILOWATT-HOURS GENERATED AND COAL USED IN GLASGOW STATIONS DURING TWENTY YEARS

on the thirty-one electricity supply concerns in Scotland is of the order of 120,000 kw. If Scotland is divided into three areas, the lowlands south of the Tay will represent two areas, and the whole of the land north of the Tay will represent the third area. Taking Falkirk as the boundary between the two lowland areas, the demand in the western area is 80,000 kw.; the demand in the eastern area is 25,000 kw.; and the demand in the third or northern area is 15,000 kw. Three moderate-sized stations would therefore meet the entire demand for Scotland, the major portion of the whole being from Glasgow and the West of Scotland.—London *Electrician*, July 7, 1916.

Installations, Systems and Appliances

Slate Quarries.—G. K. PATON.—An illustrated paper read before the Liverpool Engineering Society. The author deals with the introduction of electric power into the slate quarries of North Wales and discusses especially slate sawing machinery, the lighting equipment of the slate sawing shops, the haulage systems, inclined rope-way hoists, and aerial suspension cableways and their electrical equipment. In a particular plant where there is a preponderance of winding and consequently peak load, the load factor taken over a day of nine hours is 43.5 per cent. The load factor taken over a month and twenty-four hours per diem is 12 per cent. The plant diversity factors-ratio of total horsepower installed in kilowatt to average maximum load on chart equals 2. In other words, a demand of 250 kw. on the power plant will supply a quarry plant totaling 500 kw. The ratio is still further increased by totalling the individual quarry horsepower connected against the actual maximum demand on the power station, which gives a diversity factor of about three. The advantages of bulk supply are pointed out. The equipment of a slate quarry with electrical power is highly recommended. The cost of electric power and machinery is only one item, small when compared with other expenditures in a quarry;

but it is one which will give a quick return and enable a manager to devote all of his energies to other problems in the production of slate.—London *Electrician*, June 30, 1916.

Female Substation Attendants.—A note stating that, owing to the war conditions, girls are used as attendants in the substations of Glasgow where they attend to the 500-kw. rotary converter units with great success. The women are trained first for three weeks at the head office and then sent for a further three weeks to the substation before they are considered sufficiently proficient to take charge. The wages are $5.25 per week while under training, and $6.75 per week on attaining proficiency. They are engaged for a week of fifty-four hours, but the actual average hours per week is only fifty-one. Nine women are up to the present employed at four substations in all, and in addition there are three at the Port-Dundas power station, taking instrument readings, keeping records, and generally doing the work hitherto done by the fourth engineers.—London *Elec. Eng'ing*, July 6, 1916.

Switchgear.—A profusely illustrated article on standard British practice in switchgear for central stations and isolated plants.—London *Electrician*, June 23, 1916.

Electrophysics and Magnetism

Thermionic Currents.—Two papers on the subject. The first, by O. W. Richardson and Charles Sheard, refers to the variation of the positive emission currents from hot platinum with the applied potential difference and discusses some peculiarities of the current-voltage curves for the initial positive emission. In the second paper, by Horace Lester, an account is given of the continuation of this investigation and it is shown that there is an initial growth in the value of lack of saturation, and that there is a peculiar over-shooting effect. These facts, together with the more generally known behavior of initial thermionic currents, indicate that the observed peculiarities of initial thermionic emission may be explained as due to the influence of ionized surface-films.—*Philos. Mag.*, June, 1916.

E. M. F. Generated by the Rotation of a Cylindrical Magnet About Its Axis.—G. F. HULL and A. B. MESERVEY.—An abstract of an American Physical Society paper. An electromagnet with poles in the form of hemispherical shells is made to rotate about its axis of symmetry. A ring of brass or iron is held at rest between the poles. Brushes rotating with the magnetic shells make contact with the inner and outer edges of the ring and are connected to insulated metal rings on the axis. When the magnet rotates, an e.m.f. is picked up by sliding contact on these metal rings. The amount is equal to that which is computed from the product Nn when N is the total magnetic flux through the fixed ring and n is the number of revolutions per second. If we adhere to the idea of magnetic lines of force, quantitatively the result is in agreement with the view that the lines of force rotate with the magnet and sweeping across a fixed conductor produce in it an e.m.f. equal to Hlv. The experiment is being continued.—*Phys. Rev.*, June, 1916.

Units, Measurements and Instruments

Frequency Meter.—W. PEUKERT.—A long English translation in abstract, with illustrations, of his recent German article on a new frequency meter which was already described in the Digest.—London *Electrician*, June 16, 1916.

Measuring Transformers.—M. ILIOVICI.—A long mathematical paper illustrated by numerous diagrams. Measuring transformers introduce errors into alternating-current measurements, especially of power and energy, on account of the variability of the transformation ratio and of the phase difference between primary and secondary emfs. The author gives a graphical method and an analytical method for determining the errors due to the use of a measuring transformer, if the transformation ratio at no load, the no-load current, the hysteresis angle, and the resistances and reactances of the primary and secondary are known.—*Bulletin de la Soc. Internat. des Elec.*, April, 1916.

Telegraphy, Telephony and Radio

Wireless Telegraphy in Alaska.—A. H. GINMAN.—A paper in which the chain of semi-high power stations (25 kw.) established by the Marconi Company at Ketchikan, Juneau, and Astoria in Alaska are described. The masts, insulation, antenna, power supply, rotary converter, discharger, and relay key of these stations are considered in detail. The climatic and radio stray conditions are shown to be unusual. Remarkable directive absorption is encountered. The favorable receiving conditions are illustrated.—*Proceedings Instit. of Radio Eng.*, June, 1916.

Wireless Telegraphy.—LOUIS W. AUSTIN.—A paper on experiments at the U. S. naval radio station Darien, in the Canal Zone. The results of measurements of the strength of received signals at Darien from a number of stations are given. A specially modified ultraudion circuit is used. The Austin-Cohen formula is found to give much closer agreement with the observations than the Sommerfeld formula. Relations between received current and audibility are given for the audion and ultraudion.—*Proceedings Inst. of Radio Eng.*, June, 1916.

Amplitude Relations in Coupled Circuits in Wireless Telegraphy.—E. LEON CHAFFEE.—A paper in which an historical survey of previous work on coupled circuits is first made. There are formed, in general, in coupled circuits two waves in both primary and secondary circuits. The amplitude ratios of the longer two of these waves and of the shorter two of these waves are calculated. Neglecting resistance, the shorter waves are opposite in phase, the longer waves in phase. A simple experimental method for rapidly verifying the theoretical relations is described. The ratios of the amplitude of the longer to the shorter primary wave and of the longer to the shorter secondary wave are theoretically determined for both condenser excitation and inductance excitation. It is shown that at resonance the magnetic fluxes of corresponding long or corresponding short waves are equal numerically. It also appears that maximum secondary effect is not obtained for equal natural periods of the circuits. The extent to which wave meter close coupling affects accuracy of wave length determination is considered. An explanation of dissymmetry of resonance curves about the resonance point is also given. All relations deduced are graphically illustrated.—*Proceedings Inst. of Radio, Eng., June*, 1916.

Miscellaneous

British Municipal Electrical Association.—An account of the annual convention of the British Incorporated Municipal Electrical Association held in London. A. C. Cramb's presidential address dealt with legal matters, with work of the different committees, and with British trade after the war. F. M. Long is the new president.—London *Electrician*, June 23 and 30, 1916.

Export Trade of Great Britain.—Tables showing the registered exports of British and Irish electrical goods from the United Kingdom for the month of May, 1916, in comparison with the returns for the preceding month. The May figures for electrical exports and imports show markedly increased values in nearly all sections of the table. The table of electrical imports into the United Kingdom is also given for the same month.—London *Elec. Rev.*, June 30, 1916.

Stray Losses in Direct-Current Machines

To the Editor of ELECTRICAL WORLD:

Sir:—The no load iron loss of a direct-current machine may be readily obtained by driving it at no load and measuring the increase in power required as the excitation is increased. When the same machine is operated under normal load conditions the iron losses are increased due to field distortion.* The iron losses under these conditions, however, cannot be measured.

If a machine with a compensating winding is available, the field distortion

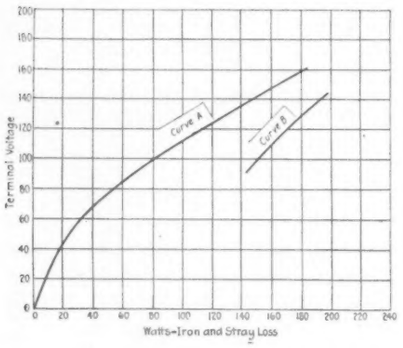


FIG. 1—NO LOAD IRON LOSSES WITH ZERO AND 1.5 TIMES FULL LOAD CURRENT IN COMPENSATING WINDING.

as obtained in standard machines may be imitated by exciting the compensating winding. If then the losses are measured first without and then with current in the compensating winding, the increase of loss in the latter case gives the additional stray loss due to field distortion. Curve *A* of Fig. 1 shows the iron losses with normal field excitation; that is, the no load iron losses, obtained from a 5-hp. Thomson-

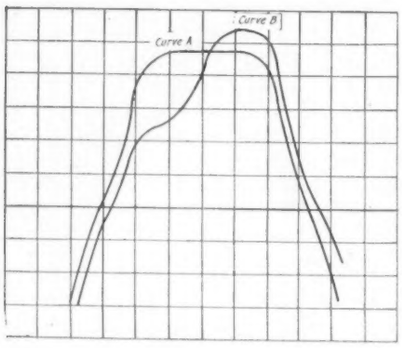


FIG. 2—FLUX DISTRIBUTION UNDER POLE SHOE

Ryan machine with the compensating winding carrying no current. Curve *B* of Fig. 1 shows the losses when, in addition, the compensating winding is carrying one and a half times full load current. The increase of loss at normal voltage due to field distortion is about 50 per cent. Curves *A* and *B* of Fig. 2 show the corresponding flux distribution under the pole shoe.

*"Iron Losses in Direct Current Machines," by B. G. Lamme, A. I. E. E. Proceedings, August, 1915.

Readers' Views and Comments

The above data is of interest, as it gives an idea of the order of magnitude of the additional loss, but it should be noted that the compensating winding is not so well distributed as an armature winding and so does not give exactly the same field distortion. It was thought desirable, however, to draw attention to the method of test, which was suggested by Prof. Alexander Gray.

W. C. KING,
M. B. MCDERMOTT,
F. W. MAXSTADT,
Sibley College, Cornell University,
Ithaca, N. Y.

"Man Factor" in Accident Prevention

To the Editor of ELECTRICAL WORLD:

SIR: Considerable attention has been given to preventing accidents by providing guards for machines and moving parts and by issuing rules for the protection of workmen, but little stress has been laid on impressing individuals with the part each can take in avoiding injury. The "man factor" has come to be of greater importance recently since other conditions contributing to accidents have been gradually eliminated by providing mechanical guards and correlating the operations of employees. Of the accidents which are due entirely to "man factor" some are caused by carelessness, thoughtlessness or mental aberration. A few examples of accidents resulting from these causes will be cited to call the attention of safety committees to the need of urging and educating employees to keep their minds alert when they are working with dangerous potentials and to protect themselves and fellow-workers.

One accident known to the writer although not due exactly to the heedlessness of the man who was hurt, would have been less disastrous had he made certain that his instructions to deenergize a feeder had been complied with. Conditions leading up to the accident were as follows: A substation operator, desiring to change over the plug connections on a 6000-volt arc-circuit board, had given orders to his machine tender to short-circuit the Brush arc machine. The machine tender, who was a new man on the job, was afraid of handling the switch, so instead of firmly closing the switch, he snapped it shut with the result that it bounced open again. The operator, in the meantime, having seen the tender go to the machine, took it for granted that it had been short-circuited, and pulled the plugs of the 6000-volt circuit which was still alive. A tremendous arc ensued which severely burned the operator about his hands and face.

In another case a rotary-converter tender was burned by opening the wrong switch. The operator of the station had "cleared" the transformers of a rotary converter from the alternating-current bus and had disconnected the machine from the direct-current bus, and the machine was slowing down.

Under the instructions of the operator, the rotary tender had shut off the air blast to the transformers and was to open the low-tension switch between the transformers and the machine. After turning off the air blast, he left the transformer for a minute or so, for some reason or other, and then returned to open the low-tension starting switch between the transformers and the converter. Instead of going to the starting switch of the rotary which had been removed from the line, he opened the switch of the next machine which was carrying a load of about 1000 kw. Naturally, a powerful arc occurred which burned him severely. Evidently the man must have been thinking of something entirely foreign to what he was doing at the time. This is an example of carelessness which is not especially confined to new men.

In another case, failure of an employee to do the thing he started out to do caused his death. The accident occurred in a large generating station where trouble was experienced with a belt conveyor used for handling coal in the bunkers. Since it was against the rules of the company for a man to go into the bunkers alone, two men went up to investigate the cause. On locating it in one of the gear bearings, one man operated a switch automatically opening the oil switch which controls the motor circuit. There being no no-voltage releases on the auto-starters of the motors, he then went around and presumably opened the knife switch for each motor. Actually, however, he opened all of the knife switches except the one controlling the motor on which he intended to work. Not knowing this, he telephoned to have the oil switch closed, and then evidently seated himself on the gear preparatory to repairing the bearings. While so seated the oil switch was closed and as the knife switch on that particular motor had not been opened, the motor started, catching the employee in the gears and grinding him to death. While this is a rather uncommon accident due to carelessness it is typical of conditions that must be dealt with.

In this case, as well as others, it seems hardly possible that any further protection than that provided by the rules could have been afforded the employees by the company. Nevertheless, the company is now considering installing no-voltage releases on the auto-starters so that if for any reason the power is interrupted the machines cannot start automatically as was the case in this accident. Such is the penalty inflicted on a company when it fails to train employees to the seriousness of carelessness.

JULIAN LOEBENSTEIN.
New York City.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. I. MANGE

John I. Mange, who has been elected vice-president of the J. G. White Management Corporation, New York, N. Y., has been associated with the company since 1912, when he was elected vice-president of the Associated Gas & Electric Company, a holding company of electric and gas properties in New York, Kentucky, Ohio and Tennessee, managed by the J. G. White corporation. Mr. Mange was born in Pembroke, Me., in 1876, and was graduated in 1899 from Tufts College, with the degree of Bachelor of Science. He has been connected at various times with the following companies: Charleston Consolidated Railway, Gas & Electric Company, at Charleston, S. C., as chief electrician; General Electric Company, Switchboard Department, at Schenectady, N. Y.; Lachine Rapids Hydraulic & Land Company, at Montreal, as electrical engineer; Oneonta, Cooperstown & Richfield Springs Railway, at Hartwick, N. Y., as electrical engineer and superintendent; Plattsburg Light, Heat & Power Company, at Plattsburg, N. Y., as secretary and superintendent; Watertown Light, Heat & Power Company, at Watertown, N. Y., as general manager.

W. C. Williams has been appointed manager of the Cincinnati branch of the Robbins & Myers Company, Springfield, Ohio, succeeding G. H. Liebel, who recently became president and general manager of the Liebel Manufacturing Company of Cincinnati.

Emlin S. Hare, formerly vice-president and general sales manager of the Commercial Truck Company of America, Philadelphia, Pa., has been appointed manager of the Packard Motor Car Company of New York. Mr. Hare was until recently manager of the motor-truck department of the New York Packard branch.

S. T. De La Mater, for the last four years with Graham, Burnham & Company, and previously with James Stewart & Company of New York and with the L. P. & J. A. Smith Company of Cleveland, Ohio, and other engineering and contracting companies, is now president of the Chicago General Construction Company, located at 833-834 Manhattan Building, Chicago.

George B. Muldaur is serving as traveling secretary for the National Electric Light Association.

Theodore M. Dame has been appointed general manager of the Boyertown Electric Company of Boyertown, Pa.

F. D. Naumann has been appointed superintendent and chief engineer of the Salt Lake & Utah Railroad, with headquarters at Salt Lake City, Utah.

B. H. Clingerman, formerly general superintendent of the Mobile (Ala.) Electric Company, has been promoted to the vice-presidency and general managership of the Northern Idaho & Montana Power Company, with headquarters at Tacoma, Wash.

C. E. Greenwood, who has been appointed superintendent of the appliance exchange of the Edison Electric Illuminating Company of Boston, Mass., succeeding W. Graydon Stetson, has been connected with the commercial department of the company for the last ten years. Mr. Greenwood is a native of Boston, and was graduated from Harvard College in the class of 1904. He entered the employ of the Boston Edison Company in 1906, beginning work in the contract department. He later became special agent, giving particular attention to isolated plant work. For the past four years he has also edited *Edison Life*, one of the most creditable publications issued by a utility organization. Last year in his capacity as assistant manager of the 1920 Boston Electrical Show, he made a 9000-mile trip to the Pacific Coast with C. J. Hatch, manager of the forthcoming exposition. Mr. Greenwood is vice-president of the Boston Edison Company Section of the National Electric Light Association and has a host of friends in the New England electrical field.

C. E. GREENWOOD

J. B. MURRAY

Joseph Bradley Murray, who was recently made assistant general manager of The Edison Electric Illuminating Company of Brooklyn, is the son of Thomas E. Murray, vice-president of the company. Young Mr. Murray is a graduate of Sheffield Scientific School, Yale, class of 1910. Upon leaving college he entered the testing department of The New York Edison Company and a year later became associated with the Electrical Testing Laboratories, New York City. Four years ago he became affiliated with the Brooklyn Edison Company, where his rapid rise has been due to studious application and conscientious effort, backed by a mind naturally adapted to the grasping and solving of central-station problems.

F. M. Murphy, formerly sales manager for the Bates Expanded Steel Truss Company, Chicago, Ill., has resigned to enter other business.

Albert Uhl, sales manager of the Goodman Electric Construction Company, 403 Transportation Building, Chicago, has been elected secretary of the company.

W. I. Sturtevant has been appointed general superintendent of the Beaumont (Tex.) Light & Power Company. Mr. Sturtevant is a graduate of the Massachusetts Institute of Technology and for some years has been employed by the Stone & Webster Engineering Corporation of Boston, Mass.

L. G. Shepard has resigned as general sales manager and electrical engineer of the Federal Sign System (Electric) Company, Chicago, to join the organization of the Milwaukee Western Fuel Company, Milwaukee, Wis. Mr. Shepard has been connected with the Federal organization since 1905, starting in as superintendent.

W. R. McCann, after serving for a year as private secretary to Commissioner Walter A. Shaw, of the Illinois State Public Utilities Commission, has been appointed valuation engineer for the commission. Prior to going with the Illinois Commission, Mr. McCann spent several years on the Panama Canal work, in charge of electrical design and construction, reporting to the electrical and mechanical engineer, Edward Schildhauer.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Large-Capacity Tank-Type Circuit Breakers

The main changes that have been made recently in tank-type oil-break circuit breakers, manufactured by the General Electric Company, Schenectady, N. Y., have been introduced to make the breakers more accessible for inspection and repair. No radical departure in the design of the energy carrying or operating parts has been necessary. The indoor and outdoor types of breakers are practically similar, the only difference consisting of the addition to the indoor breaker of a few parts to enable it to be serviceable both from a mechanical and an electrical standpoint under all weather conditions. The K-21 and K-26 oil-break circuit breakers are used indoors on pressures of from 35,000 volts to 150,000 volts, and the K-22 and KO-26 outdoors on pressures of from 22,000 volts up to 150,000 volts. The K-22 apparatus is like the K-21, except that the K-22 apparatus has outdoor bushings and the mechanism is protected from the weather by an iron housing. The KO-26 breaker is like the K-26, except that weatherproof covers and bushings are used for outdoor installations.

SOLENOID-OPERATED 35,000-VOLT OIL CIRCUIT-BREAKER EQUIPPED WITH TANK LIFTER

A noteworthy advance in the breakers, says the manufacturer, consists of mounting them on framework and in the handling of the tanks by a tank lifting device recently perfected. The lifter consists of a detachable frame with shaft, handle, worm gear and winding and unwinding drums. The device is readily detached and can be moved by one man from one switch to another, thus making it a very simple operation to lower or raise an oil tank, and also making it easy to align, inspect contacts and oil, and replace contacts if necessary.

The top connected circuit breakers are self contained for use on systems of potentials up to and including 200,000 volts. One tank with two breaks in series is used in each phase. The breakers are made for either automatic or non-automatic operation. They may be closed by hand, solenoid or air, and the automatic breakers are tripped under overload by series trip coils (mechanical trip indoor only) or current transformers. When hand operated the circuit breakers can be installed behind the switchboard panel with the operating handle in front and connected to the breakers by connecting rods and bell cranks. All the breakers can be mounted on a framework except those for operation on 110,000 volts and above. They can also be operated by a removable wooden lever connected directly to the mechanism. When solenoid or air operated, the breakers may be located where desired and controlled from the switchboard or other convenient place by a pull control switch or air valve.

The operating mechanism and bushings are secured to the cast iron cover of the heavy sheet steel tank. Each bushing extends through the switch cover into the oil, and is so clamped to the cover that the throwing of oil is impossible. The bushings are easily removable and interchangeable. There are two fixed contacts in each switch element between which one phase of the circuit is made and broken by a horizontal contact blade. Each contact blade is connected to the operating mechanism by a specially tested hardwood rod, which passes through the cover of the switch in an insulating bushing. The stationary contacts consist of widely flared fingers and long arcing tips of drop-forged copper secured to the contact block by flat steel springs, copper laminations and screws. The contacts are always smooth and bright due to the sliding effect they are subjected to on opening and closing and the arrangement of burning tips. The oil tanks are of sheet steel of ample strength, it is declared, for the service required.

The oil furnished for these breakers is known as "G-E Oil No. 6," and is especially adapted for this service, since it has a very high flash point and high resistance to carbonization. The insulating value of the oil and its burning and carbonizing characteristics make a difference in the length of time the arc will hold. Wherever the temperature goes below 0 deg. C. "No. 19 oil" is used.

Electric Washing Machines

Two new washing machines were exhibited by the Western Electric Company, New York, at its booth at the recent exhibit of the National Electric Light and National Electrical Contractors' Associations. One of these machines is of the dolly type and the other a small cylinder washer.

The dolly washer is a motor driven machine, among the features of which is a movable wringer that swings in various positions around the body of the machine, permitting the wringing and re-wringing of clothes into tubs or on table tops without moving the washer or stopping its operation. A safety release offers protection from the rollers. The motor is placed under the tub and is protected from dripping water. The gearing is covered and is absolutely safe, it is claimed.

The small sized cylinder washer is built and operates on the same principle as its larger prototype that has been marketed by the Western Electric Company for some time past. It is designed to wash four sheets or the equivalent at one time. The machine is sturdily built of non-warping wood and is lined with galvanized steel. The lining is of one piece and rounded, thus allowing no corners, cracks or crevices to catch and hold the dirt. The cylinder is of the familiar perforated wooden type with slats especially made to withstand warping, and works on the

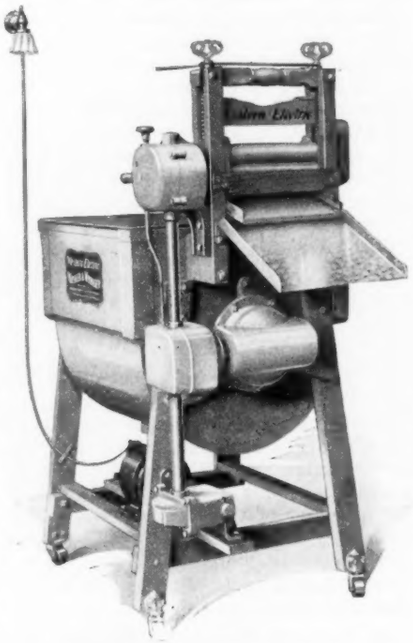


FIG. 1.—SMALL CYLINDER WASHER

reversing principle. The wringer is driven by the motor, is reversible and can be operated in conjunction with or independent of the cylinder. It has a

FIG. 2—DOLLY-TYPE WASHING MACHINE

safety release that obviates wringer accidents. The motor is mounted under the body of the machine and away from water and moisture. All gears and shafts are inclosed and protected.

Electromagnetic Vibrator

In the accompanying illustration is shown a new electromagnetic vibrator for use on alternating-current circuits, which is being manufactured and marketed by the Rubes Electric Devices, Inc., Brooklyn, N. Y. The applicators for this vibrator may be attached so as

ALTERNATING-CURRENT VIBRATOR

to operate in either of two directions at right angles to each other. One produces a lateral or so-called Swedish massage stroke, and the other a percussion stroke. The vibrator delivers about 7200 vibrations per minute, operating on an electromagnetic principle and employing no rotating electric motor. There is, therefore, the minimum of mechanism to get out of order and to require oiling.

The vibrator outfit is furnished packed in a leatherette cylindrical carrying case and consists of one vibrator with a 10-ft. cord and an attachment plug for connecting to an electric-light fixture. Eight applicators are furnished also with the equipment.

Intercommunicating Telephone

The Screw Machine Products Corporation of Providence, R. I., is placing on the market a new interior telephone service known as the "Select-o-phone" system. The switchboard is automatic, requiring no operator. Three ordinary bell wires radiate from the central station to each instrument installed, and any station can be called by any other

FIG. 1—WALL INSTRUMENT

station by simply turning a small dial on the telephone base to the number desired. The connection and ring are automatic as soon as the receiver is lifted. The switchboard is claimed to be trouble proof; the lower part contains all terminals for the switchboard wiring and line connections, while the upper part contains the selectors which operate automatically with the dial on the telephone base.

One important feature of the "Select-o-phone" system, the maker points out, is the general call by means of which the party wanted is reached immediately when he is away from his own station. In this case, the dial is moved to "general call" and a pre-arranged signal sounded throughout the plant, hearing which the party answers from the nearest station. In cases of overtime work and emergencies such as fire and burglary, the "Select-o-phone" is particularly well adapted and is at the instant service of anyone who may be in the plant. Furthermore, should an

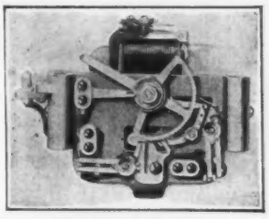


FIG. 2—SELECTOR FOR INTERCOMMUNICATING TELEPHONE

executive desire a conference with two or more departments the "Select-o-phone" gives him this service. He calls the parties wanted, asks them to connect at the conference point, and by connecting his own instrument also he has an immediate conference without calling any man away from his department, and without wasting any time waiting for the men to walk from their offices to his. While the conference is in progress no one can get the executive on the line, as any attempt to ring a station engaged gives the busy signal. Another advantage of the system to which attention is directed by the manufacturer is the freeing of outside telephone lines from personal conversations to the betterment of the outside service. A saving in time and effort is also effected by the automatic feature of the system which makes it necessary for the operator to attend only to outside calls, devoting the time saved to useful clerical or stenographic work. If, during a conversation on an outside wire, information from a certain department is needed to complete the conversation this may be secured quickly and privately by using the "Select-o-phone" while the party waits on the outside line.

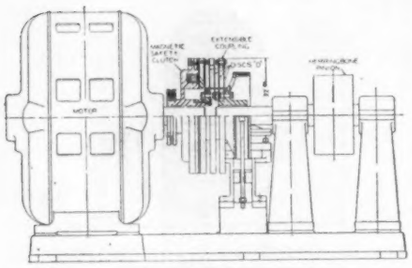
New stations may be added to the system from time to time as desired without disturbing any of the previous wiring. The central station being constructed on the unit basis, any trouble arising on one line does not affect any other line. In fact it is stated by the manufacturer that no trouble can arise on the system which cannot be quickly repaired by the manufacturer's own handy man. It is also stated that the greatest economy of the "Select-o-phone" service comes from the increased use of the telephone as a means of transacting business, since it encourages its own use because it is so easy to operate.

Extensible Coupling for Mill Drives

Any user of herringbone gears is familiar with the bad effect of end thrust, or any constraint which does not leave the gears perfectly free to align themselves. The resulting noise, vibration and wear is very objectionable, especially in the case of rubber calendar rolls where a very smooth action is desired. Many efforts have been made to

remedy the trouble, which has always been an objection to the use of herringbone gears.

The use of any fixed end thrust



EXTENSIBLE COUPLING INSTALLED ON TYPICAL MILL DRIVE

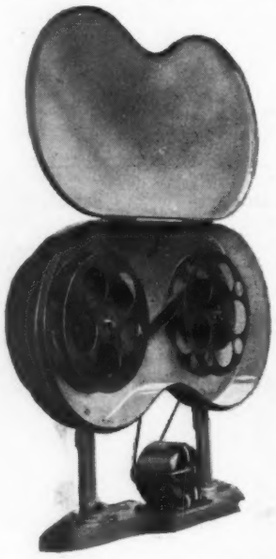
causes too much constraint, and the lack of such thrust allows any lateral motion due to the drift of the motor armature or any other external forces acting on the shaft to be transmitted directly to the piston, with the disagreeable results before mentioned. Flexible couplings have been, and are being widely used with the idea of relieving the gears from these end thrusts, but the existing types, it is pointed out, are designed primarily to take care of misalignment and possess sufficient axial friction at working loads to transmit end pressures of objectionable magnitude; they therefore do not afford a true solution of the problem. The problem was to design some form of connection between the motor and herringbone pinion which would (1) transmit the necessary power, (2) leave the pinion free to align itself with the gear, and (3) leave the pinion unaffected by any end thrust caused by lateral motion of the shaft. In other words, what was wanted was a perfectly extensible coupling.

Such a coupling has been recently put on the market, and it is shown herewith. It is shown in connection with a magnetic safety clutch which has been in use on calendar rolls for some years. The clutch and coupling together are particularly well adapted for driving rubber rolls. The mechanical construction of the coupling is very simple and the only problem in the design was to make the disks *D* as strong as was necessary to transmit the torque, and at the same time secure the utmost flexibility independent of the amount of torque transmitted. The amount of torque transmitted is only dependent on the thickness of the disks, and the size of the bolts. The extensibility is dependent on the flexibility of the disks, and is independent of the amount of torque transmitted, in that it is the same when no load is being transmitted as when the load is maximum.

In order to secure the utmost extensibility the disks are laminated, *i.e.*, each disk consists of several thin disks bolted together. The deflection of a thin circular plate under a given load varies inversely as the cube of the thickness. Three ⅛-in. disks will transmit the same torque as one ⅜-in. disk, but the three thin disks will deflect nine times as easily as the one thick disk. Practice has demonstrated the correctness of this theory, the maker declares, and in the case of a 32-in. coupling recently built the force necessary to cause a deflection of a large part of an inch was much less than the end sliding friction in the bearings. While so far the coupling has been applied only to rubber calendar work, it is not limited to this field, and may be applied in any case where a truly extensible coupling is desired. It is being manufactured by The Cutler-Hammer Clutch Co., Milwaukee, Wis.

Motor-Driven Film Rewinder with Automatic Stop

The rewinder illustrated, called the Horting machine, has been designed so as to assure absolute safety in the winding and rewinding of moving pic-



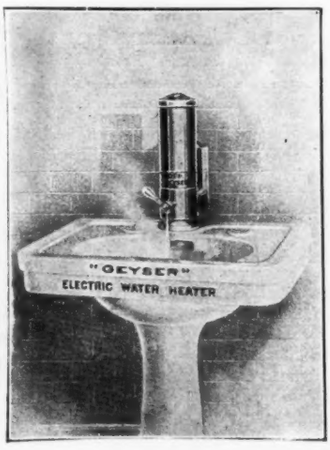
MOTOR-DRIVEN FILM REWINDER

ture films. It is being made by The Automatic Film Rewinding Company, Harrisburg, Pa., and is said to be the only machine approved by the National Board of Fire Underwriters that entirely incloses the film when rewinding. The machine is driven by an inclosed Westinghouse motor. The cost of operation is said to be less than 5 cents a day, based on a twelve-hour performance. As shown by the illustration the rewinder is very simple in construction, being supported by two uprights which in turn rest upon an iron base, giving proper rigidity without undue weight. There are two magazines, one larger than the other. Each is a separate inclosed compartment, with a cast-aluminum cover or protector designed to conform to the shape of the reels. The larger magazine is used for the reels during rewinding; the smaller one contains the operating mechanism. The machine will take reels of 2500 ft. or less of any make, and will operate only when the magazine covers are closed, unless set for examination or inspection of the film. This feature makes it foolproof, checking the possible explosion of exposed films due to carelessness. The attention of the operator is not required at the end of a film as the machine will automatically stop when the film has been completely rewound. Should the film break while the machine is in operation the rewinder will automatically stop at the point where torn and allow splicing after which it will proceed to rewind the balance of the film on the reel. Operators and owners are often given a great deal of annoyance by the presence of "rain" on the screen. This is caused by dust and particles of dirt which collect on the face of a film during rewinding, when such rewinding is done in the ordinary way. Since the rewinder shown winds the films under cover, perfect pictures are assured as no dust can get on the film.

Instantaneous Electric Water Heater

A water heater which can be attached to an ordinary water hydrant, as shown in the accompanying illustration, and which is designed to heat the water instantaneously is being made by the Bridgeport Electric Company, Bridgeport, Conn. By turning the faucet to the left cold water is obtained and to the right hot water. By means of this small heater, which is contained in a case of seamless brass tubing 12 in. long and 4 in. in diameter, a system of hot-water piping and heating equipment is obviated.

The heater consists of a resistance wire extending through a series of holes or passages in a cylindrical body of porcelain contained in the metal casing. The water circulates through the same passage that contains the resistance wire, and is drawn off as needed by opening the faucet. The turning of the handle of the faucet by the user automatically actuates a double pole snap switch for turning the electric circuit "on" or "off." The tem-



WATER HEATER ATTACHED TO WATER-SUPPLY SYSTEM

perature of the water can be regulated by the quantity of flow from the faucet at any temperature up to 212 deg. Fahr. The porcelain body is 4 in. in

diameter and is made up of four sections, two of which are 4 in. long and two of which form caps 1 in. thick. Fourteen 0.5-in. holes extend through the 4-in. sections and contain the resistance wire, while recesses in the cap sections between the ends of adjoining holes provide a continuous passage in series from inlet to outlet. The joints between the porcelain sections are provided with asbestos gaskets. The heater is rated at 25 amp. at a pressure of 250 volts. Tests made by the Underwriters' Laboratories, Inc., show that the heater and control switch are of a substantial and durable construction, adapted to withstand service for a long period of use and that under normal conditions of operation the device affords a ready means of heating water in a relatively safe manner.

Reflectors for Portable Lamps

As is well known, materials such as silk and cretonne are very poor reflectors. In the "Arca" lamp shown herewith the disadvantages of silk and

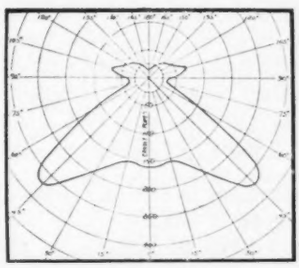


FIG. 1—PHOTOMETRIC CURVE WITH 100-WATT LAMP

cretonne shades are overcome by the use of a specially constructed reflector which is designed to direct the light rays to the spot where they are most needed and diffuse them so that a soft light is distributed all over the room. The makers claim that the "Arca" reflector is a scientifically constructed

FIGS. 2 AND 3—PORTABLE LAMP WITH REFLECTOR, WITH AND WITHOUT SHADE

prismatic reflector. It consists of an upper prismatic part which reflects the light and a lower part which diffuses the light and distributes it over a very large area. Fig. 1 shows the photometric curve of the reflector used with a 100-watt lamp. The "Arca" lamp can be used to good advantage for indirect as well as direct lighting, the manufacturers point out. An especially noteworthy feature of the reflector, the makers further declare, is the economy of light.

For reading purposes the same reflector inverted can be used. A lamp with an ordinary silk shade only throws the light around the base of the lamp. The reflector shown is designed to distribute the light over a large area and direct it over a large table or writing desk without throwing any light into the eyes of the reader. A considerable saving is also obtained by using the inverted reflector, it is claimed. Any portable lamp can be converted into an indirect lighting or direct lighting "Arca" lamp for any purpose, for the library, dining room, bedroom, it is asserted, and even with boudoir lamps the "Arca" reflector can be employed very effectively. The holder used for the reflector can be easily adjusted to any kind of lamp. Fig. 2 illustrates an ordinary portable lamp fitted with the "Arca" reflector for indirect lighting. Fig. 3 shows the same lamp with a cretonne shade, showing the light flux. Fig. 4 shows the inverted reflector used with a small portable lamp, and Fig. 5

FIGS. 4 AND 5—INVERTED REFLECTOR, WITH AND WITHOUT SHADE

illustrates the same lamp with a cretonne shade.

All metal parts, such as sockets and other parts, are concealed from the eye, so that the appearance of the lamp is improved.

The "Arca" reflector opens new possibilities for better lighting effects in the home. Furthermore, by means of shades the reflector can be entirely concealed. The reflectors are being marketed by the United Arts & Crafts Workers, New York.

Small "Daylight" Lamps

The Lux Manufacturing Company of Hoboken, N. J., has just placed on the market 40-watt and 60-watt Lunar blue-glass lamps for producing illumination of "daylight" color and quality, in show windows, printing establishments, textile mills and other places where a close approximation to daylight illumination is desirable for color matching. The smallest "daylight" lamps heretofore marketed have been the 100-watt units previously described in these columns. The new lamps are

60-WATT BLUE-GLASS LAMP

identical with the gas-filled tungsten lamps manufactured by the Lux company and are made for pressures from 100 volts to 130 volts.

Boiler Wall Coating

Every engineer who has trouble getting perfect fuel combustion will be interested in "J-M" Aertite," a new boiler wall coating which has just been placed on the market by the H. W. Johns-Manville Company, New York. The need for an easily applied coating to prevent air infiltration is apparent, it is asserted, when it is realized that imperfect combustion, with its corresponding heat loss, is due to the use of too much air in firing, and particularly to too much air leaking into the boiler. Each crack and crevice in the boiler setting allows air leakage and permits the air to mix with the flue gases before perfect combustion takes place and prevents their giving up the maximum number of heat units. Not only this, but the air which leaks in is cold and uses up heat units which should be developing steam. The result is decreased boiler efficiency. According to claims of the maker the above mentioned boiler wall coating applied to the outside of the boiler wall entirely eliminates air infiltration. It provides a tough, rubbery coating or blanket over the entire boiler setting which remains tight on account of its adhesive and ductile qualities. It is easily applied by troweling on the outside of boiler walls. The best results are obtained by keeping the thickness as near 1/16 in. as possible.

The quantity required to cover 100 sq. ft. depends upon the number and variety of cracks and the way the wall has been pointed up. For a thickness 1/16 in. it will take approximately 25 lb. to 40 lb. per 100 sq. ft.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

COST ACCOUNTING FOR MANUFACTURERS AND DEALERS

Federal Trade Commission Issues Two Pamphlets to Aid in Determining Manufacturing Costs and the Principles Underlying Them.

Two pamphlets on cost accounting, one for manufacturers, entitled "Fundamentals of a Cost System for Manufacturers," another for retailers, entitled "A System of Accounts for Retail Merchants," have been issued by the Federal Trade Commission at Washington. Edward N. Hurley, chairman of the Federal Trade Commission, in his letter of transmittal states:

> The Federal Trade Commission has found that an amazing number of manufacturers, particularly the smaller ones, have no adequate system for determining their cost and price their goods arbitrarily. It is evident that there must be improvement in this direction before competition can be placed upon a sound economic basis.
>
> With the object of aiding in the improvement of business generally, we have endeavored in this pamphlet to show briefly the importance of accurate manufacturing costs and the fundamental principles underlying them. I commend it to your attention and feel satisfied that if you will read it carefully you will find many helpful suggestions.
>
> The pamphlet has been prepared under my direction by Mr. Robert E. Belt, Chief Accountant, and Mr. R. W. Gardiner, Assistant.

In the booklet for manufacturers is presented in simple and direct style the elements of a cost system for a manufacturing establishment, together with description of suitable financial and operating statements and ledger accounts and statements. In the pamphlet for the dealer is shown a form of monthly summary for business, a profit and loss statement and a balance sheet. The main body of the pamphlet for the retailer is made up of a description of these forms, and credit is given to the Bureau of Business Research at Harvard University for the classification and definition of expense accounts. Both these pamphlets are well worth the study of the manufacturers and the contractors and dealers in the electrical trade.

As the ELECTRICAL WORLD stated editorially, and as Mr. Debevoise, counsel for the Electric Supply Jobbers' Association and the Associated Manufacturers of Electrical Supplies, made clear in a special article last week, a common understanding of what constitutes the cost of doing business must underlie the development of the industry. It would be worth the while of every man in the electrical trade to send for copies of these pamphlets and to see how they may be applied in his business.

Binghamton Electric Company to Construct New Power Plant

Due to rapidly increasing business, the Binghamton (N. Y.) Light, Heat & Power Company, has outgrown the capacity of its present station, and recently purchased about 20 acres of land, known as the Crocker property, bordering the Susquehanna River, near Johnson City and adjacent to the Lackawanna Railroad, upon which it will erect a new power station. The building will be approximately 60 ft. by 80 ft., and constructed of brick with steel frame. The brick stack will be 200 ft. in height and 12 ft. in diameter at the top.

The new plant will be equipped with machinery of modern design, capable of operating under maximum economy. The initial capacity will be 7500 hp., with provision for other units to be installed as future requirements may demand. The boilers, turbines, generators and other essential parts of the equipment have been under order for several months, and the work of constructing the plant has already been started. The company states that the new plant should be in operation not later than Jan. 1, 1917. The engineering and construction of the plant will be under the direction of W. S. Barstow & Company, Inc., New York.

10,000 Electric Flatirons Sold in Kansas City in July

The Kansas City (Mo.) Light & Power Company sold through its electric shop more than 10,000 electric flatirons last month. Almost all of these were General Electric 6-lb. flatirons usually retailing at $3.50, the selling price during the campaign being $2 in monthly installments of 25 cents added to the light bill. About 300 other irons were sold during the month at prices ranging from $3.50 to $5.

The company had contracted for the 10,000 irons at a low price last fall, and in spite of the expensive advertising campaign and the low price of the iron it made a profit on the sales. Incidentally, the electric iron sale brought customers to the electric shop who spent nearly $10,000 for other electrical devices. The gross receipts of the electric shop for July were close to $29,000, or several thousand dollars in excess of the entire gross receipts for the entire year of 1915. All classes of advertising, including motion picture films, were employed to create interest in the sale, and local dealers and contractors also co-operated. In order adequately to handle the increased business the sales force was augmented, and during the last days of July the lamp department was called on to supply men to give additional help to take care of customers.

Storm Damage in West Virginia

As the result of a cloudburst in the Kanawha and New River Valley of West Virginia on Wednesday of this week, the mining regions of Cabin Creek and a part of Paint Creek were swept by flood. Along the Cabin Creek many coal mines were flooded and some of the tipples swept away. There was a loss of life estimated at 100 and a property damage of coal companies placed at not less than $1,000,000.

The 20,600-kva. steam generating station of the Virginia Power Company on the west bank of the Kanawha River at Cabin Creek Junction, which serves the coal mines of this section, suffered only slight damage, mainly from washouts on the grounds. A few transmission towers and one substation in the path of the flood were damaged. However, the greatest loss to the company will result from curtailed operation of the coal companies which suffered damage and have mines flooded. At this time the loss of revenue from this cause cannot be estimated.

Public Service Commission News

Indiana Commission

The Public Service Commission of Indiana has denied a petition for another electric light plant in Crothersville, on the ground that the city already has one lighting plant and that public convenience and necessity does not demand another.

The Public Service Commission has approved a new rate schedule for the city of Muncie. The new rate is 8 cents with a ½ cent discount for prompt payment, and the monthly minimum charge has been reduced from $1 to 50 cents. Electric rates have also been ordered reduced in the town of Bunker Hill. The former maximum rate of 12 cents per kilowatt-hour has been reduced to 10 cents, and the street lighting rate has been cut from $32 a lamp a year the former rate to $25 a lamp a year.

Illinois Commission

The Illinois Commission has handed down a decision in the case of the city of Belleville vs. the St. Clair County Gas & Electric Company, ordering that the rate to be hereafter observed and enforced by the St. Clair Gas & Electric Company for each 4-amp. magnetite arc lamp for municipal street lighting for the city of Belleville, Ill., shall be $60 per annum per lamp. The original order was entered by the commission under date of Nov. 24, 1915, at which time the commission found the valuation of $350,000 to cover the used and useful electric property of the company in Belleville, and after having fixed upon 7¼ per cent per annum as a reasonable and proper rate of returns upon the said valuation and upon 4.4 per cent per annum as a reasonable and fair rate of depreciation upon the said valuation, determined and prescribed certain schedules of rates to be charged electric consumers in Belleville. Subsequently, on Dec. 29, 1915, the respondent filed with the commission a petition for a rehearing of the entire case, alleging numerous errors in the commission's determinations of rates.

The Commission granted a rehearing on the question, "What is a reasonable and fair rate for electric street lighting service in Belleville?" and the rate originally fixed of $55 per annum for each 4-amp. magnetite arc lamp was suspended. It was brought out in the hearing that since the date of the original valuation a new type of street lamp has been installed at a considerable cost to the company. With the value of the street lamp equipment, both in the station and on the line, as a basis, and using the same operating expenses, rate of return and rate of depreciation as was brought out in the original record, the commission found that $60 per annum for each 4-amp. magnetite arc lamp is a fair and reasonable rate and is sufficient and adequate to provide for just and ample operating expenses, etc.

In the matter of the purchase and sale of electric property in Christopher and Sesser by the Central Illinois Public Service Company from the Tyrone Electric Company, the State Public Utilities Commission approved the purchase price of $70,000, which is $10,000 in excess of the present value of the tangible physical property, on condition that the $10,000 excess of cost over value be amortized before 1937 out of the purchaser's net income.

The facts in the record are that in 1913 the Tyrone Electric Company purchased existing electrical property in Christopher having a physical value of $18,955.13 and a book value of $19,581.23 for $32,500; *i.e.*, $13,544.87 for such going value and good will as may have existed at that time. Since 1913 property added to the Christopher plant amounts to $8,415.88 and property retired amounts to $6,620, a net total book value of $21,377.11. Since 1913 the Tyrone Electric Company has constructed the Sesser distribution system and the necessary interconnecting transmission line at a book cost of $31,231.19. The total book value of the property to be transferred therefore is $52,608.30 (undepreciated), plus some $13,000 of going value paid in 1913. Accounts receivable, accounts payable, and other assets and liabilities, other than those involved in franchises, contracts, rights-of-way, etc., were not transferred.

In the appraisal, the petitioners set the reproduction value (undepreciated) of the tangible property under consideration to be $53,293, and the original cost (undepreciated) to be $54,299. To the estimated reproduction cost, the appraiser added a blanket $20,000 for going value, and to the original cost added estimates of $7,566 for operating loss in 1913 on transmission lines and Sesser distribution system, of $7,500 for operating loss in Christopher, and of $3,258 for interest, taxes and insurance during construction, totaling $73,293 as an estimated reproduction value and $72,623 as an estimate of original cost.

In its opinion the commission draws attention to the marked distinction between a rate case and a security-issue or purchase-and-sale case. Part of the argument is given herewith:

"In the Decatur Telephone consolidation case involving the purchase and sale of utility property, this commission set forth principles which in many respects are quite applicable to the case herein. Authority was granted to the petitioning utilities therein to purchase and sell property at a consideration in excess of the actual present value of the said property, provided that only the present value of the said property be capitalized. On the theory that the public would be benefited by the proposed consolidation the purchasing utility was granted permission to charge to operating expense, over a term of years, such items of equipment as have service value in the previously existing separate operation of the two utilities, but which would be obsolete in the combined operation. The excess of the purchase and sale consideration over the present value of the property, plus such an amount as was permitted to be charged to operation, with the allowance for the scrap value to be realized from the sale of discarded equipment, was required to be amortized out of net income within a period of twenty years or, in the opinion of the purchaser, charged to profit and loss at any time."

The commission's opinion concludes with:

"In accordance with the principles enunciated in the aforesaid Decatur Telephone consolidation case, this commission finds (1) that the Central Illinois Public Service Company may purchase, and the Tyrone Electric Company may sell, the entire property of the said Tyrone Electric Company for a consideration of $70,000; (2) that the fair present value of the said property which may properly be capitalized permanently is $60,000; (3) that the said expenditure of $70,000 neither in whole nor in part is reasonably chargeable in any manner to the future operating expenses of the Central Illinois Public Service Company; (4) that the sum of $10,000 is to be amortized out of the income of the Central Illinois Public Service Company, and (5) that the prayer of the aforesaid petitions should be granted, subject to the terms and conditions prescribed hereinafter, provided, however, that the approval of the purchase and sale herein, for a consideration of $70,000, and of the permanent capitalization of $60,000 thereof, shall in no manner be binding upon this commission should the question of fair and reasonable rates in the said municipalities of Christopher and Sesser arise at some future time."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Twelve Hundred Pacific Gas & Electric Employees in Preparedness Parade.—In the preparedness parade held in San Francisco on July 22, the division in which the Pacific Gas & Electric Company employees marched moved 1200 strong. The total number who covered the line of march from the ferry building to Van Ness Avenue was over 51,000.

Short Circuits Caused by Snakes.—The *Edison Current Topics*, published by the Southern California Edison Company of Los Angeles, says that "cooking by wire" is gaining in popularity especially among the feathered tribes. Two transmission line short circuits were recently caused by birds dropping snakes across the line. The snakes were beautifully roasted.

Ashland Cuts Rate for Ranges.—An ordinance has been passed by the city council reducing the rates for energy for electric ranges in Ashland, Ore., from 6 cents to 3 cents per kw. hr. This action supplements the previous enactment affording free energy for porch lamps. The reductions are the result of a favorable contract with the California-Oregon Power Company in addition to facilities afforded by the municipal electric light plant.

Memorial to the Late Professor Thompson.—Suggestions having been made in several quarters that a memorial to the late Prof. Silvanus P. Thompson should be established, the Finsbury Technical College Old Students' Association has taken the matter up and now is engaged on the formation of a scheme to enable all those interested to perpetuate the memory of the deceased in a suitable manner. J. E. Raworth, 28 Broadway, Westminster, London, is president of the association.

Columbus Dealer Establishes Branches.—The Avery-Loeb Electric Company, electric dealer of 114 North Third Street, Columbus, Ohio, has decided to establish branches in each of the four principal sections of the city, east, west, north and south. These branches will prove of convenience to people in those sections, and will make it possible for farmers to do business with the concern without making the long trip to the business section of the city during the busy seasons.

Municipal Plant to Increase Rates.—Owing to the increasing cost of materials and labor, the Municipal Light Board of Westfield, Mass., has decided to increase the price of electricity. The present lighting rate is 7 cents per kilowatt-hour and the increased rate will be 9 cents. The minimum charge per month will be 50 cents. The present power rates are now 2, 3 and 4 cents, based on the amount used per month. The new rates for power run from 2½ cents to 5¼ cents. The minimum charge will be 75 cents plus 50 cents per horsepower or fractional part thereof of connected load.

Unprofitable Consumers of Electricity in Chicago.—It appears from the records of the State Public Utilities Commission of Illinois that the number of electric consumers in Chicago whose bills during the year 1915 amounted to less than 50 cents a meter a month averaged 12,446 a month. With a minimum bill of 50 cents a month applied to these consumers the revenue of the Commonwealth Edison Company would have been increased by $40,624.

Defective Insulators Shut Down Ontario Hydro System.—A report from London, Can., states that this week there was a five-hour shutdown of the Ontario hydro system owing to defective insulators. Sir Adams Beck says the commissioners are interested in securing, if possible, an insulator that will withstand 150,000 volts. The experts of the Ontario Hydro Electric Power Commission are experimenting with a view of securing insulators that will prevent any more breakdowns.

Fear Cleveland Municipal Plant Is a Losing Venture.—In an interview on Aug. 3 Light Commissioner Davis of Cleveland expressed the fear that the steadily increasing cost of operation of the municipal light plant will make it a losing venture with energy at 3 cents per kw.-hr. Aside from this, he fears that the accountants now going over the books will find that interest charges on from $1,000,000 to $2,000,000 will have to be added to the burden to put the plant on the proper basis.

Electrically-Operated Coke Plant.—The new by-product coke plant of the Youngstown (Ohio) Sheet & Tube Company is to be operated with electric energy. It will be completed the latter part of the month, but was given a try-out on Aug. 3. The substation contains three Crocker-Wheeler 1200 kva. synchronous motor-generators with the necessary transformers. A Wellman-Seaver-Morgan car dumper, operating over a 62 ft. lift, is driven by two 400-hp. Westinghouse motors and cars up to 100-ton capacity can be handled. Belt conveyors are used to handle the coal and coke.

Unprecedented Fan Business Causes Telephone Peak.—Under ordinary conditions the twenty-two-section switchboard in the Commonwealth Edison Company's private exchange at Chicago undergoes two peak loads annually. These occur about May 1 and Oct. 1, the moving days, when the apartment and house leases of most of the city's population expire. This year a third peak occurred when, during the last days of July, the excessive heat caused an unprecedented demand for electric fans. During the period from June 26 to July 29, 1646 fans were sold, 1037 of them on July 27, 28 and 29.

State Banks Invest in Utility Bonds.—The following quotation from the Chicago *Examiner* of July 31 indicates the faith of bankers in the strength and stability of public utilities securities: "The report of the state auditor of the aggregate of the bank reports made to him as of July 1 is of interest because of comparisons made of the investment holdings of state fiscal institutions. All banks own $80,393,000 of public utility bonds as compared to $38,870,000 of state and municipal bonds and $43,900,000 of all other bonds; in other words the banks have invested in utility bonds as much as in all other forms of bonds. More interesting is the fact that public utility investments increased to $2,313,000 during the interval between calls, while commitments of other sorts were practically stationary."

Shortage of Power in Ontario May Stop Export to U. S.—On July 17 there was no power available in Windsor, Ont., from the lines of the Windsor Hydro-Electric System for several minutes. Although the shortage was temporary, previous breaks, it is stated, have frequently occurred owing to the excessive overload on the system. In commenting on this condition Premier W. H. Hearst stated: "No further permits will be given to any private concern to export power from the province. The provincial government will not accept the responsibility for the lack of power, which caused the whole hydro-electric system to shut down Monday afternoon, July 17, from seven to eleven minutes. It is now up to the Federal Government to cancel licenses of companies which prefer to sell power to United States consumers rather than to the commission for distribution in the province."

Electricians Seek More Pay.—Electrical workers throughout New England are making demands for more pay and their organizers are busy forming local brotherhoods in sections where unions are not now in existence. Notice of intended changes in the working agreements have been filed by the Electrical Workers Local No. 223 with the master electricians of Brockton, Mass. An advance of 5 cents an hour to 55 cents this year, 57½ cents in 1917 and 60 cents in 1918 is asked. The present wage schedule is 50 cents an hour for an eight-hour day. One of the changes in the new agreements will also call for the suspension of the apprentice system. The union is desirous of having the changes go into effect Oct. 1. The electrical workers and contractors of Holyoke, Mass., have agreed upon a wage schedule. Workers and contractors in Holyoke, Springfield, Westfield and Northampton, Mass., will be affected by the new arrangement. Organizers are busy in various sections of Maine.

Pasadena Municipal Plant Grows.—The municipal lighting system in Pasadena, Cal., put 1074 new meters on its lines in the fiscal year just closed, according to a report which also states that the system now serves nearly 9000 consumers.

Union of German Technical Association. — A "Verband" of the principal German technical associations has been formed under the name of the Association of German Scientific Societies. Those societies comprising the "Verband" are the Institution of German Electrical Engineers, the Institution of German Engineers, the Institution of German Architects, the Association of Blast Furnacemen, the German Chemical Society, and the Association of Shipbuilding Engineers. Headquarters are in Berlin. The "Verband" will thus represent 60,000 members of the different professions involved. One of the principal results which is looked for from the combination is the furtherance of the work of finding substitutes for the raw material hitherto obtained in neutral countries or those with whom Germany is now at war.

Minimum Charges for Electricity in Cities of 250,000 and Over.—In testimony before the state public utilities commission of Illinois in the matter of the proposed change of rates for electric service in Chicago there was introduced a statement of the minimum bills in effect in the cities of the United States having a population in excess of 250,000 people. This list is as follows:

New York	0 per month
Omaha	50c. per month
Detroit	50c per month
New Orleans	50c per month
Kansas City	50c per month
St. Louis	50c per month
Milwaukee	50c per month
Louisville	50c per month
Pittsburgh	50c per month
Los Angeles	65c per month
Philadelphia	75c per month
San Francisco	75c per month
Cleveland	$1 per month
Brooklyn	$1 per month
Minneapolis	$1 per month
Washington	$1 per month
Newark	$1 per month
Jersey City	$1 per month
Cincinnati	$1 per month
Boston	$9 per annum
Buffalo	$12 per annum
Baltimore	$12 per annum

Standards for Electric Service.—The Bureau of Standards Department of Commerce, Washington, D. C., has issued circular No. 56 "Standards for Electric Service" which discusses the facts constituting and promoting safe and adequate electric service. The circular, which is based on a study of the experience of operating companies and regulating bodies, contains first, rules and recommendations for the regulation of electric service companies by state commission; second, three different ordinances intended for towns and cities in states not having regulation by commissions, and third, specifications for the approval of types of electric meters by commissions. A brief description of the electrical testing equipment provided by each state commission for the calibration and standardization of "working test standards" used by central stations in their meter work and for making tests on consumers' meters upon complaint to commissions is also included. Reprinted in appendices are certain sections of state public service commission laws relating particularly to the regulations of electric service as to adequacy and safety and in addition tables and summaries on various phases of voltage regulation, meter testing and general central station statistics. The Bureau of Standards asks for criticisms and suggestions from operating companies, commissions, inspectors, committees of associations of engineering societies and all others interested in the establishment of proper standards for electric service. The circular is now ready for distribution and may be obtained free by addressing a request to the Bureau of Standards, Washington, D. C.

Electrical Trade in England. — The president of the Institute of Electrical Engineers of Great Britain having been recently invited to give evidence before the Electrical Trades Committee it was resolved by the Council that the following recommendations based upon the conclusions reached by a special committee of the whole Council be submitted by him to the Board of Trades Committee on behalf of the Council:

1. Some combination of British electrical firms, especially with regard to overseas trade, is desirable.

2. A Government Tribunal of the most independent character that can be devised to be appointed to control the electricity supply industry of the country, and also to prevent indiscriminate addition or extension of power stations or systems undesirable from the point of view of size, locality, or system.

3. In view of the necessity of securing the home market and that none other than British electrical apparatus be purchased in the United Kingdom, a protective tariff to be set up, notwithstanding such benefits as will in any case result from patriotism.

4. A permanent advisory committee to be appointed to insure that, as far as possible, raw materials and parts, as well as whole apparatus necessary to the trade of the British Empire, shall be produced within the Empire.

5. (i) British-born electrical attachés to help in the consular service, and (ii) trade commissioners to be appointed.

6. British engineering standards to be adopted throughout the empire.

7. The use of the metric system to be made compulsory after a reasonable period; and during this period all trade catalogs to make use of both the British and metric systems.

8. The Institution to be granted a charter so as to improve the status and training of electrical engineers.

9. A Central Engineering Board, consisting of representatives nominated by all the important institutions, to be established whom all engineers (other than mechanics) would be required to satisfy as to the sufficiency of their technical training and general education before they could be recognized as proficient, so as to insure that every engineer shall qualify for his profession in the same manner as a doctor or solicitor.

10. Closer co-operation of manufacturers and other employers of electrical engineers with the technical colleges is desirable to insure that students are trained to meet the future needs of the industry.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Jovians Will Hold Rejuvenation at Nela Park.—On the afternoon and evening of Aug. 19 the Sons of Jove will hold an original outdoor rejuvenation at Nela Park, Cleveland.

Electric Club Reorganized in Oklahoma City.—The Electric Club of Oklahoma City has been reorganized and is now meeting for noon luncheon every Monday. This will enable members to become better acquainted and to hear talks, both technical and non-technical. The club has a membership of fifty and Geo. W. Knox, general manager of the Oklahoma Railway Company, is president.

Cleveland Electrical League.—The new quarters of the league on the roof of the Hotel Statler will be completed within a short time and it is now thought that moving day will not be later than Sept. 1. Secretary R. S. Dunning said that there will likely be a housewarming when the club rooms are completed. No more regular meetings will be held by the league until the new home is occupied.

Synchronous Club.—At a meeting of the Synchronous Club held in Los Angeles Aug. 3, J. E. McDonald, secretary of the Joint Pole Committee, Southern California, addressed the club on "Joint Pole Construction." At the conclusion of the address the annual election of officers was held, the officers elected being as follows. President, Leslie E. Martin; vice-president, R. H. Cates; secretary, Frank McGinley; treasurer, J. M. Geopfert; sergeant-at-arms, H. N. Beecher.

Cincinnati Jovian Outing.—The annual outing of the Cincinnati Jovian Order held at Beechwood Park on July 29 was largely attended, a barbecue, with several varieties of meats roasted outdoor in Kentucky style being a big drawing card. A big program of athletic events and a ball game also helped to add interest. A. C. Beattie headed the committee in charge of the affair, with J. Nolloth as secretary and Claude Johnston as treasurer.

Cincinnati Electrical Show to Broaden Scope. — The Ohio Valley Electrical Exposition is the name under which the Cincinnati electrical show of Nov. 18 to 25 will be held this year, indicating an increasing scope for the event. In fact, it is intended by the directors to make it a national electrical show, and as many manufacturers have already made inquiries regarding space, and promise co-operation, it is expected that there will be no difficulty in enlisting the aid of the industry to make the affair a complete success.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

WIRE AND CABLE PURCHASES EXCEED LAST YEAR'S RECORD

Although Export Business in Rubber-Insulated Conductors Is Handicapped by British Ruling, the Wire Manufacturers Are Experiencing Boom Times

All lines of conductors, including underground cables, are selling unusually well now, the business being 30 to 40 per cent better than last year. This decided improvement is partly due to the fact that the financial depression of last year delayed many companies in their purchases until this year. Increased demands of industrial concerns and their consequent adoption of electric drive to permit flexible output has also increased the call for wire and cable. Another reason for the increase in sales is that buyers have been waiting for a lower copper price (which is the basis for cable as well as plain conductors), but the price having risen steadily have purchased for future needs in anticipation of still further increases and prolonged high prices.

Most of the orders have come from large central stations which make a practice of periodically supplementing their distribution mains and feeders, although many orders have also come from small companies which do so spasmodically. Considerable quantities of the conductors purchased are also for railway electrification purposes. Sector-conductor cable is being purchased more freely as the companies gradually awaken to the economies afforded by its use.

While copper and lead are the outstanding constituents of underground cable and the chief basis on which its price depends, paper for insulation is also an influencing factor. Some companies are having difficulty in securing the right grades of paper while others who have been placing their orders continually with the same producers are receiving assurances of a continued supply in return for their past steady patronage.

Exports of bare and paper insulated wire and cable are large in comparison with previous years, especially to German markets, orders having been received from Norway, Sweden, China and the East Indies. English markets are being well supplied by British manufacturers. Exports of rubber-insulated wire and cable are, however, seriously handicapped by the British ruling that rubber purchased from English markets cannot be reshipped or resold to other countries without permission. This ruling has been enforced even where rubber-insulated wire has been consigned to a neutral government for its own use. Exportation of cables is also somewhat handicapped because nearly every government specifies different requirements.

FLEXIBLE WOVEN DUCT BUSINESS MOVES SLOWLY

Orders for Fall Deliveries Are Normal, but Export Business Is Nil—Packing Material Difficult to Secure

Trade in flexible woven duct has been healthy but a decline in business is now being experienced. This is attributed to jobbers who have over specified in their spring orders and must now wait until fall to place further orders. Orders are now coming in at a healthy rate but most of them are for fall delivery. No particular territory seems to be demanding duct above the usual rate. Some territories are not demanding woven duct in proportion to their populations but in most cases this is due to the fact that the local underwriters have restricted its use. While prices have been advanced there does not seem to be any decrease in buying, and purchasers seem to be taking advantage of the discount offered with prompt payment. There is not much export business in woven ducts since it is relatively little known abroad. Therefore it cannot be sold in foreign countries on an extensive scale without first educating the electrical contractors there.

Although the prices on raw materials used in making woven duct have risen there is not much difficulty in securing them because they are all domestic products. One manufacturing concern reports that it is prepared to furnish any amount of woven duct that may be demanded since it makes its own machines and therefore has a flexible capacity for production. Deliveries have been hindered, however, because paper boxes of sufficient strength are difficult to obtain. This obstacle has been overcome in some cases by inserting liners in the boxes.

LARGE DEMAND FOR INSULATORS MAKES DELIVERY SLOW

Shipments Promised in from Three to Four Months—Pole and Transmission Line Hardware Especially Difficult to Get at Present

High-tension insulator orders are booming in spite of the fact that few steel towers are being erected. This apparent inconsistency may be due to the use of wood poles instead of steel towers for main line construction. Another explanation is that manufacturing concerns which have experienced inflated demands for their products may be changing over to electric drive to permit a more flexible output. In such cases probably wood-pole lines equipped with high-tension insulators have been tapped on to main lines to serve them. The last reason seems the most probable since most of the insulator orders except a few large ones for railway-electrification and station-interconnection projects are for companies serving industrial territories. One insulator manufacturer reports that it has on hand orders for 400,000 insulators and that the plant is crowded to its utmost production limit. Most of the orders are for 22,000 to 66,000-volt insulators. Delivery on additional orders can not be made in less than from ninety to 120 days, provided popular sizes rated for these voltages are wanted. Orders on special designs are not accepted at all. Less called for sizes are not subject to the same delays in delivery. Promises of quicker deliveries are difficult to obtain anywhere since some manufacturers when unable to fill orders in the time specified by customers have been advised to hold the orders until they can fill them. Higher prices occasioned by the rise of metals for insulator fitting and the scarcity of labor do not seem to be affecting the buying, evidently because the purchasers must have the equipment.

The chief obstacle to making deliveries is the difficulty of securing malleable iron parts for the insulator units. Only the standard types of malleable fitting can be secured since the iron works are so busily engaged in more profitable lines that they can not consider making special types. This condition of course does not affect the delivery of pin insulators. However, some difficulty is being experienced in getting imported constituents for porcelain.

The scarcity of labor has not only required the paying of higher wages to secure it but of raising the wages of employees already engaged to a similar level to prevent dissatisfaction and poor workmanship. The latter is a

particularly important factor in the manufacture of insulators since their quality depends so closely on the care of each workman. Another item that has seriously hampered the insulator manufacturers is the high price of packing materials, such as wood boxes, excelsior and nails. While transportation of freight has been delayed by the embargoes existing in some sections of the country very little trouble is being experienced from this direction now.

RENEWABLE FUSE BUSINESS GROWS BETTER EVERY MONTH

Manufacturers Have Calls for All Sizes, Chiefly from Industrial Plants—Prices Fluctuate and Deliveries Are Subject to Delay

Business for the manufacturers of renewable and refillable fuses is in general above normal and for some manufacturers is getting better every month. The increases in the business apply to fuses of all sizes, as is to be expected, for the fuse business always acts that way. For instance, if there is a general increase for any given year of 10 per cent in the general fuse demand, the increase in the demand for 30-amp. fuses, 50-amp. fuses, etc., will each be about 10 per cent.

The main volume of business coming to the makers of renewable and refillable fuses is from industrial plants. For this reason the manufacturers see in the immediate future an outlook that is exceedingly bright. Looking into the distant future after the war, they see a condition that is doubtful and about which there is little which can now be said.

Prices are subject to fluctuation. Raw materials, brass and spelter, have increased from 300 per cent to 800 per cent above the prices in normal times. Labor cost has increased only slightly, due to the fact that a great deal of the work consists of light assembling in which girls and boys are employed. In spite of the increase in material costs, a few of the manufacturers have held prices at practically their former level, while others have found it necessary to put increased quotations in force. Those who have held prices at their former level have done so with the expectation that customers will appreciate a standard price level policy and will continue to buy their products even when normal raw material prices allow others to reduce.

Fuse deliveries, which are classified in the trade as slow, are excellent as compared with many other lines. Some of the makers are quoting from one week to three months, depending on the size of fuses desired. The deliveries of raw materials to the factories are said to be getting a trifle better.

Collections are good. One manufacturer said of his collections that he knew of only one business that could boast of better collection conditions than his and that was the mail order business where the money is paid in advance.

BUSINESS IN TRANSMISSION LINE TOWERS SLACK

Restrictive Water Power Legislation and High Price of Money Suggested as Cause of Present Stagnant Condition

Except in a few isolated cases very few steel towers are being erected by electric service companies at the present time and orders for future deliveries are scarce, according to engineers closely in touch with the transmission field and with the output of large manufacturers of steel structures. About the only steel structures that companies are installing are yard structures such as terminal frames, lightning arrester supports, outdoor substations and the like. Companies in Texas and Utah are especially active in this line. Towers for railroad crossings make up the remainder of steel structures now on order or being erected. Many of these are being erected in New Jersey, Connecticut and Maine.

The slackness in tower business may be due to any one or combination of the following causes: Increased prices (probably 100 per cent higher than two years ago due to metal prices and scarcity of labor); agitated water power legislation which discourages installation of hydroelectric plants and consequently lessens the necessity for transmission lines; and finally, but probably most important that electric service companies can not afford to pay the interest to secure money that bankers can obtain from industries which have had a phenomenal increase in business. Consequently bankers are placing their money where they can derive the most benefit. Probably any legislation that will encourage the development of water powers will be attended by the release of more money to central stations, since then bankers might consider lower profits in view of having their investments protected.

The depression in tower business dates back about two years, however, to the time when financial conditions were uncertain and metal prices began to soar. Despite the fact that the total tonnage of steel towers now on order is less than the capacity of any one of the steel-structure manufacturers, many regular manufacturers complain of small steel-pole and structure concerns which are cropping up around the country and are nothing more than blacksmiths. These "mushroom" concerns, it is claimed, are indiscriminately advocating the use of steel poles for all purposes to further their ends, without having sufficient engineering knowledge to design the structures properly when orders are landed.

ARGENTINE ELECTRICAL IMPORTS

Less Than $600,000 Out of $10,000,000 of American Manufacture

An analysis made of the Argentine electrical exports during 1913 discloses the fact that of a total of almost $10,000,000 worth of goods less than $600,000, or slightly more than 6 per cent, were imported from the United States. Germany was the principal source of supply, with a total of $4,967,002, or 51 per cent. The United Kingdom came next with $3,333,316, or 34.2 per cent. Italy, which is seldom considered as a factor in the world's electrical trade, was represented by goods to the value of $494,615, or 5.07 per cent of the total.

Out of a list of twenty-eight different articles American products lead in but two cases, both of which were small, namely, vulcanized fibre and small motors. Of the former 71.3 per cent of the value was in goods of American origin and of the latter 72.4 per cent.

In 1914 the total imports of electrical goods into Argentina dropped to $6,736,815, but how much of this was of American origin is not yet known.

No figures are available for 1915, but it is known that if American exports of electrical goods to Argentina keep up at the rate of the past few months more than $1,000,000 will represent the United States share in the 1916 electrical imports of Argentina.

ARGENTINE ELECTRICAL IMPORTS DURING 1913

Articles	Total	United States	Percentage U.S. Goods
Storage batteries	$26,886	.....	....
Station meters	32,257	.....	....
Dry batteries	45,640	12,773	28.00
Bells and buttons	28,829	4,798	16.65
Accessories for underground	162,984	40,470	24.82
Lamp carbons	133,340	.....	....
Battery cells	18,367	.....	....
Commutators	17,927	3,239	18.09
Dynamos and motors	1,088,029	45,517	4.18
Electric fans	89,681	13,973	15.60
Vulcanized fibre	32,120	22,859	71.36
Bell indicators	7,196	.....	....
Insulating appliances	467,280	37,638	8.07
Battery jars	6,408	.....	....
Arc lamps	225,559	.....	....
Incandescent lamps	478,101	41,077	8.59
Lamp sockets	60,471	10,070	16.67
Meters	687,887	10,179	1.48
Small motors	88,595	64,091	72.40
Battery plates	104,259	.....	....
Plugs	15,001	.....	....
Fuses	40,657	.....	....
Switches	107,848	41,725	38.70
Switchboards	32,647	.....	....
Telegraph material	43,486	.....	....
Telephone material	148,318	15,791	10.64
Wall sockets	14,572	4,793	32.90
Wire and cable	4,772,534	116,561	2.44
Miscellaneous	779,358	101,802	12.90
	$9,756,247	$587,356	6.03

Manufacturing and Industrial

C. M. Garrison has purchased a considerable amount of machinery and is about to install it in a plant in Newark, N. J., for the purpose of manufacturing bare and finned copper wire.

Spark-Plug Display Stand.—The Hartford (Conn.) Machine Screw Company is offering to dealers handling its "Master" spark plugs an attractive display. Particularly noticeable is the "Mammoth" plug, which can be seen for quite a long distance. The stand is 20 in. high and is finished in three colors with a brilliant red background while the plugs are finished in silver and blue.

The National Safety Council, Continental and Commercial Bank Building, Chicago, is distributing a series of bulletins on accident prevention in factories that may be read with profit by all manufacturers and posted on factory bulletin boards. The annual congress of the National Safety Council is to be held in Detroit, Oct. 17 to 20, 1916. The secretary of the association is W. H. Cameron.

Russia to Spend Large Amount of Money on Utilities.—According to an announcement made by W. Aiseman, chief of the Russian trade division of the National Association of Manufacturers, Russian agents in New York have authority to buy enormous quantities of materials for construction of new public utilities. The project includes water works, gas works, electric light plants, electric railroads, etc., and it is estimated that the total cost of the new developments will approximate $300,000,000.

National Trademark Suggested.—Congressman Kitchin of North Carolina has introduced a bill to authorize the adoption of a national trademark for the manufacturers of the United States, particularly for export purposes, and to authorize the Secretary of Commerce to license manufacturers to use the same and for other purposes. The bill, which has been referred to the House committee on Ways and Means, proposes a distinctive trademark to be used by manufacturers in the United States for the purpose of distinguishing American products. The Secretary of Commerce would be authorized to design, or select from designs submitted to him, a suitable trademark which would be registered in the name of the United States, and its use by American manufacturers permitted under a system of federal licenses at a cost, it is stated, of not more than $5 per annum.

General Vehicle Company Moves District Offices.—The New England headquarters offices of the General Vehicle Company have been moved from the Exposition Building, Cambridge, Mass., to a new building at 590 Commonwealth Avenue, Boston, in the heart of the recently developed automobile district in the outer Back Bay. Under one roof are located the salesrooms and offices, service, garage, charging and repair departments, battery charging station and parts stock room. A large showroom is provided at the front of the establishment for the display of both electric and gasoline trucks. Besides several charging stations the plant contains a machine shop and forge room with separate outside entrance. About 15,000 sq. ft. of floor space are utilized. The service station is located near the principal battery and tire depots of Boston. George H. Hudson is New England manager of the company.

Philip Valk, 134 Johnson Avenue, Newark, N. J., purchasing agent for the Holland-Bombay Trading Company, and Schuurman & De Long, both of Amsterdam, Holland, is planning to sail on Sept. 2 for Amsterdam to confer with his principals. Schuurman & De Long are catering to the trade in Holland, Belgium and the Dutch Colonies, while the Holland-Bombay Trading Company has considerable dealings in British India, Gulf of Aden territory and the East Coast of Africa. Mr. Valk states that the above-mentioned concerns are especially interested in metals and metal products (metal and wood-working machinery), house furnishing goods, hardware, brushes, machinery tools, everything pertaining to the electrical line, automobile accessories, rubber and leather goods, etc. He also says that he would like to get in touch with companies who are desirous of establishing agencies in the above-named countries where his principals have connections.

More Than 1300 Cutler-Hammer Employees in Milwaukee Preparedness Parade.—The patriotic spirit of the Cutler-Hammer organization was very much in evidence July 15 when Milwaukee's Preparedness Parade took place, and miles of people, more than 30,000 in all, marched. The Cutler-Hammer marchers were strung over a distance covering several city blocks, the number in line being about 1300. This large number of a total of 1600 employees is strong proof of the family spirit existing in the Cutler-Hammer ranks. President F. R. Bacon, Treasurer F. L. Pierce, and General Manager A. W. Berresford marched with the rest of the company's workers and held their places in line even when a rainstorm drove many people to cover. The company's division was headed by a special band which was followed by a battalion of employees dressed as marines. Following were other men and women carrying flags, and red, white and blue parasols—all wearing colored paper hats.

Insurance for Public Utility Companies.—Lynton T. Block announces that on July 31 the Utilities Fire Indemnity Exchange commenced writing fire insurance policies on the property of public utilities and electrical contractors. For several years the Utilities Indemnity Exchange has been accepting fire insurance and placing it as advantageously as possible for the public utility industry and through its efforts a saving of over 25 per cent on the cost of their insurance has been effected. The experience on the business written, however, proved that the lines served by the exchange were bearing an undue proportion of the fire losses and accordingly as soon as the proper amount of business had been secured a separate exchange was started. The management will be the same as the Utilities Indemnities Exchange, which has for some years specialized in liability and compensation insurance for public utilities. The feasibility of the exchange was demonstrated conclusively by the investigation made by David L. Gaskill, secretary of the Ohio Electric Light Association, and the movement grew due to the fact that the old-line stock companies refused to give any relief to the moderate-sized light plant through suitable reduction in cost. Special study has also been given the many restrictive clauses now contained on policies covering electrical machinery and apparatus, and the new exchange will write as liberal a policy as is consistent with good underwriting.

Large Switchboard Orders Placed with Westinghouse Company.—The following orders of switchboard apparatus for the initial equipment of new generating stations have recently been placed with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. The initial and ultimate kva. ratings of apparatus for these new stations, together with the number of circuit breakers included in the orders give an idea of the magnitude of the switchboard equipment involved: The Union Gas & Electric Company, Cincinnati, Ohio, New West End power house (initial rating, 62,500 kva. for three-phase, 60-cycle, 13,200-volt operation, ultimate rating, 287,000 kva.), one four-section control desk, one fourteen-panel, three five-panel, two two-panel switchboards, eight 2000-amp. type 0-2, and 58 type E-6 oil circuit breakers; the Buffalo General Electric Company, Buffalo, N. Y., New River steam station (initial rating, 66,666 kva. for three-phase, 25-cycle, 12,000-volt operation, ultimate rating, 233,000 kva.), one eight-panel, one six-panel, one five-panel and one three-panel switchboard, twelve 2000-amp. type 0-2 and seventeen 600-amp. type 0-1 oil circuit breakers; the Dayton Light & Power Company, Dayton, Ohio, New Millers Ford generating station (initial rating, 31,250 kva., for three-phase, 60-cycle, 6600-volt operation, ultimate rating, 125,000 kva.), one seven-section control desk, one ten-panel, one eight-panel and one three-panel switchboard, ten type 0-2, thirteen type E-6, sixteen type E-8 oil circuit breakers; the Montana Power Company, Holter Junction, Mont., New Holter Hydro-Electric Development (initial and ultimate rating, 48,000 kva., for three-phase, 60-cycle, 6600-volt, operation, one seven-panel, one six-panel, and three five-panel switch boards, eleven type E-6, and seven 110,000-volt type GA oil circuit breakers; the Public Service Company of Northern Illinois, Joliet, Ill., new No. 9 power station (initial rating for 12,000-kva., three-phase, 60-cycle, 12,000-volt operation, ultimate rating, 50,000 kva.), one two-sec-

tion control desk one nine-panel, one five-panel, and three four-panel switchboards, and six type GB oil circuit breakers. In addition to the above initial equipments the following represent orders recently received for additional equipment: The Duquesne Light Company, Pittsburgh, Pa., Brunots Island generating station (additional rating, 65,000 kva.), one four-section control desk, one ten-panel switchboard, nineteen type 0-1 and six type 0-2 oil circuit breakers; the Michigan Northern Power Company, Sault Ste. Marie, Mich.; hydroelectric station (additional rating, 27,000 kva.), a thirty-nine-panel switchboard, 116 300-amp. electrically-operated type B oil circuit breakers, four 3000-amp. and two 2000-amp. type E-4 oil circuit breakers; the Northern Ohio Traction & Light Company, Akron, Ohio, Gorge generating station (additional rating 44,400 kva.), equipment for three control desk sections, two type E-4 and one type C-1 oil circuit breakers; the Edison Illuminating Company, Lancaster, Pa., Engleside station (additional rating, 4950 kva.), transformers for three-phase, 60-cycle, 11,000-volt operation and equipment for three control-desk sections.

NEW YORK METAL MARKET PRICES

	Aug. 1 Selling Prices Bid	Aug. 1 Selling Prices Asked	Aug. 8 Selling Prices Bid	Aug. 8 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	109 0 0		107 0 0	
Prime Lake	25.25	to 25.75†	25.50	to 26.00†
Electrolytic	26.50	to 26.75†	26.50	to 27.00†
Casting	24.25	to 24.50†	24.00	to 24.25†
Copper wire	31.00†		31.00†	
Lead	6.50		6.00	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	15.00†		15.00†	
Spelter	9.17½	to 9.42½	8.42½	to 8.67½
Tin, straits	38.25		37.75	
Aluminum, 98 to 99 per cent	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	19.00	to 20.00†	19.50	to 20.50†
Brass, heavy	12.00	to 12.50†	12.00	to 12.25†
Brass, light	9.00	to 9.50†	9.00	to 9.50†
Lead, heavy	5.00	to 5.25†	5.00	to 5.12½†
Zinc, scrap	7.50	to 7.75†	6.00	to 6.25†

COPPER EXPORTS

Total tons to Aug. 8 5,966

†Nominal.

Corporate and Financial

American Light & Traction Company reports gross earnings for year ended June 30 $5,652,314, against $4,735,264 in preceding year; final surplus balance after payment of all dividends $11,374,789, against $10,194,491 at close of preceding year.

American Power & Light reports gross earnings for June from all subsidiary operating companies $635,844, increase $35,208; net earnings $293,589, increase $25,901; gross earnings for twelve months ended June 30, $8,076,257, increase $408,817; net earnings, $3,737,614, increase $247,166.

Asheville Power & Light Company reports gross earnings for June $38,913, as against $35,023 in June, 1915; net earnings $18,034, as against $15,289; income after charges $14,214, as against $11,089; gross earnings for twelve months ended June 30 $460,776, as against $445,359 for preceding twelve months; net earnings $208,910, as against $203,443, and net income after charges $157,733, as against $151,291.

Carolina Power & Light Company reports gross earnings for June $61,081, as against $55,947 in June, 1915; net earnings $20,393, as against $18,588; net income after charges $38,102, as against $19,132; for twelve months ended June 30, gross earnings $740,233, as against $652,941 for twelve months preceding; net earnings $280,697, as against $229,268, and net income after charges $185,096, as against $116,137.

Dubuque (Iowa) Electric Company.—An issue of $2,300,000 of first mortgage 5 per cent bonds is being offered at 97 and interest, to yield 5.45 per cent. The proceeds from the sale of these bonds will be used to retire the bonds of the former Dubuque Electric Company purchased by Elston, Clifford & Company, and to pay floating indebtedness of the concern.

Martinsburg (Va.) Power Company.—The property of the company consisting chiefly of plants at dam No. 4 and dam No. 5 on the Potomac River, a plant in Martinsburg and all the equipment for conducting the business, was sold at bankruptcy sale on July 22 by Trustee C. E. Martin. The plant was sold as a going concern, and was purchased by a representative of interests identified with the Martinsburg Power Company, known as the reorganization committee. The price was $575,000. The appraised valuation of the property was $600 000, but experts have stated that the concern is worth $1,000,000 as a going proposition. For some time past the interests controlling the company have been working on plans for a reorganization and these will now be put into operation. The company was forced into bankruptcy several months ago by securing holders and creditors opposed to the reorganization plans and the Federal Court ordered the concern sold at auction.

Middle West Utilities Company.—The Middle West Utilities Company, which owns or controls the common stock of the Central Illinois Public Service Company, announces that it will shortly serve 134 Illinois communities instead of 116. Authority has been given to increase the common stock from $5,000,000 to $7,500,000 and arrangements have been made to convert approximately $1,500,000 debentures and notes held by the Middle West company for cash advances, into common stock par for par. Additional cash advances of the Middle West company then remaining outstanding and represented by notes will by contract be made junior to the preferred stock. Furthermore, the Middle West company as of Dec. 1, next, contracts to deliver to the Central company $500,000 of debentures and take $500,000 in common stock, making a total of $2,000,000 of cash represented by securities junior to the preferred stock issued within the present calendar year. After all these transactions have been completed the capitalization of the Central Illinois Public Service Company will be $7,500,000 6 per cent cumulative preferred stock, of which $3,225,000 will be outstanding, and $7,500,000 common, of which $6,000,000 will be issued.

Niagara, Lockport & Ontario Power and Salmon River Power Company report gross earnings for June of $159,004, increase $43,425; net $80,892, increase $20,627. Six months' gross $867,229, increase $191,002; net $495,219, increase $154,889.

Sandusky Gas & Electric Company.—In order to provide for the extension of its services and improvements in its property, the Sandusky Gas & Electric Company, Sandusky, has made application to the Ohio Public Utilities Commission for permission to issue $700,000 additional capital stock.

The Central Illinois Public Service Increases Stock.—The Central Illinois Public Service Company, a subsidiary of the Middle West Utilities Company of Chicago, has filed notice of an increase in capital stock from $10,000,000 to $15,000,000. No definite announcement has been made as to when the stock will be issued or what the proceeds of the sale will be used for.

The Moore Steam Turbine Corporation, Wellsville, N. Y., has recently been organized with an authorized capitalization of $160,000 and will be engaged in the manufacture of an improved type of single and multi-stage steam turbine in ratings of from 5 hp. to 1000 hp. The officers of the corporation are as follows: J. L. Moore, president, formerly chief engineer of the Kerr Turbine Company; J. B. Laird, vice-president, formerly factory manager of the Kerr Turbine Company; E. D. Spicer, secretary and treasurer, formerly chief draftsman and acting chief engineer of the Kerr Turbine Company. Plans have been drawn and the contract will be let at once for a modern fireproof, reinforced-concrete factory building, power house and testing plant.

Uncas Power Company, Norwich, Conn.—Decision was reserved by Judge Thomas in the Federal Court on July 25 at New Haven on the motion made by counsel to dismiss the petition for a receiver for the company, filed by Helen M. Alexander of Providence, a stockholder. The petitioner contends that the company was being mismanaged and its assets wasted. The opposing counsel claimed that the petition properly should have been made to the superior court under the state corporation law.

New Utility and Industrial Companies

The Martin Wright Electric Company of San Antonio, Tex., has been chartered with a capital stock of $30,000 by Phil Wright, Martin Wright and J. G. Cummings.

The Scannell Electrical Construction Company of Toledo, Ohio, has been incorporated with a capital stock of $10,000 by N. C. Scannell, G. L. Marcereau, and others.

The Marion Electric Company of Myerstown, Pa., has been chartered with a capital stock of $5,000 to operate in Marion Township. Adam Albright of Myerstown is treasurer.

The Due West (S. C.) Power & Light Company has been incorporated by W. W. Edwards, R. B. Brice, O. Y. Brownlee and S. A. Pressley. The company is capitalized at $1,500.

The Rural Sales Company of Louisville, Ky., has been incorporated by A. W. Hudson, J. J. Knopf, Minnie F. Hudson and Marie Knopf. The company proposes to sell electrical supplies.

The Mount Aetna Electric Company of Myerstown, Pa., has been incorporated with a capital stock of $5,000 to operate in Tulpehocken Township. D. S. Martin of Myerstown is treasurer.

The Winner (S. D.) Light & Power Company has been chartered with a capital stock of $25,000 by E. L. Snyder, W. J. McFadden, C. Kilbourne of Sioux City and Claude Naule of Winner.

The Harveyville (Kan.) Electric Light Company has been incorporated with a capital stock of $12,000 to supply electricity in Harveyville. Joseph Broderick of Alta Vista is owner of the plant, which was recently installed.

The Gettysburg (Pa) Electric Company has been granted a charter with a capital stock of $5,000 to operate in Gettysburg and Straban Townships. The incorporators are: J. Edwin Weissenfluh, Wendell W. Faunce and Fred B. Atherton of Scranton, Pa.

The Mount Pleasant Light & Power Company has been chartered with a capital stock of $5,000 to operate in Mount Pleasant Township, Adams County. The incorporators are: J. Edwin Weissenfluh, Wendell W. Faunce and Fred B. Atherton of Scranton, Pa.

The Union Township Light, Heat & Power Company has been granted a charter with a capital stock of $5,000 to operate in Union Township, Adams County. The incorporators are: J. Edwin Weissenfluh, Wendell W. Faunce and Fred B. Atherton of Scranton.

The Tug River Electric Company of Welch, W. Va., has been incorporated by Claude Boughner, G. C. Sledge, G. C. Mace of Gary, L. A. Osborne and C. V. Updyke of Welch. The company is capitalized at $700,000 and proposes to operate an electric generating plant at Spriggs.

The Read Dresser Engineering Company of New York, N. Y., has been incorporated with a capital stock of $50,000 to deal in machinery, apparatus, motors, dynamos, lamps, hardware, etc. The incorporators are: G. S. and S. R. Dresser and C. P. Read of New York, N. Y.

The Ixonia-Ashippun Electric Company of Milwaukee, Wis., has been organized with a capital stock of $100,000 to construct and operate an electric plant to furnish electrical service in the villages of Ixonia and Ashippun. The incorporators are: Edmund C. Rosenburg, Phillip Grossman and E. B. Kehoe.

The Tesla Company of New York, N. Y., has been incorporated by N. Tesla, 8 West Fortieth Street; G. Scherff, 17 Battery Place, and R. D. Buttrago, 8 West Fortieth Street, all of New York, N. Y. The company is capitalized at $250,000 and proposes to manufacture machinery, engines, turbines, flying machines and apparatus for lighting, heating, telephoning, telegraphing, submarine signaling, wireless transmission.

The Indiana Power & Water Company of Bloomfield, Ind., has been incorporated with a capital stock of $200,000 as a holding company for the Utilities Development Corporation of Chicago, Ill. The company recently took over the property of the Home Light & Power Company of Bloomfield. The directors are: Archibald C. Keene, resident manager at Bloomfield, Ind.; Leo S. Kositchek of Chicago, Ill.; C. E. Gregg and A. R. Coker of Bloomfield.

Trade Publications

Heating Pads.—The Sun Ray Manufacturing Company, Oshkosh, Wis., has issued a catalog sheet on 11 in. by 15 in. Sun Ray Heating Pads.

Lighting Glassware.—Catalog No. 44, describing the "Cora" line of glassware, has been issued by the Consolidated Lamp & Glass Company, Coraopolis, Pa.

Cable Accessories.—T. J. Cope, 1620 Chancellor Street, Philadelphia, Pa., is sending out a leaflet containing a revised price list of cable accessories.

Intercommunicating Telephone.—The "Select-O-Phone" intercommunicating telephone is described in a bulletin published by the Screw Machine Products Corporation, Providence, R. I.

Electric Vibrator.—The Rubes Electric Devices, Inc., Brooklyn, N. Y., is sending out an illustrated folder descriptive of its electric vibrator recently described in these columns.

Electric Water Heater.—The "Geyser" instantaneous electric water heater is described and illustrated in a booklet recently published by the Bridgeport Electric Manufacturing Company, Bridgeport, Conn.

Ornamental Lighting Fixtures.—The New York Gas & Electric Appliance Company, 569 Broadway, New York, has published an attractively illustrated brochure which lists a large number of ornamental lighting fixtures.

Ball Bearings for Fans and Blowers.—"Trouble-Proof Fans and Blowers" is the title of an illustrated booklet brought out by the SKF Ball Bearing Company, Hartford, Conn., which describes the uses of the company's ball bearings in connection with fans and blowers.

Electric Flags.—The National Lamp Works of the General Electric Company, Nela Park, Cleveland, Ohio, has prepared an attractively illustrated booklet printed in colors which contains considerable information on the use of electric flags in various parts of the country.

Electric Cranes.—The New Jersey Foundry & Machine Company, 90 West Street, New York, has just published catalog No. 88 which describes a varied line of hand operated and electrically operated cranes, monorails, trolleys, hoists, etc.

Storage Battery for Mine and Industrial Locomotives.—The Electric Storage Battery Company, Philadelphia, Pa., has just issued Bulletin No. 159 which contains considerable information on and attractive illustrations of the application of storage batteries for mine and industrial locomotives.

Rheostats and Fans.—A 10-in. alternating-current oscillating fan is described in leaflet No. F-4352, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The company has also just published leaflet No. 1412 on starting and speed adjusting rheostats for direct-current motors.

Induction Motors and Air Compressor Equipment.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., recently published Bulletin No. 1087A on polyphase induction motors, Bulletin No. 1536 on stationary and portable air-compressor equipments for industrial purposes, Bulletin No. 1525A on Type AA-7a compressors for air-brake equipment and Bulletin No. 1530A on type AC-3 air compressors for air brakes, stationary equipments and portable equipments.

Vacuum Drying Apparatus.—The J. P. Devine Company, Buffalo, N. Y., has published Bulletin No. 101 covering a line of vacuum chamber dryer units adapted for the drying of materials that can be handled on trays or pans: Bulletin No. 102, covering a line of vacuum drum dryers, adapted for all liquid solutions containing solids, and Bulletin No. 103, covering a line of rotary vacuum dryers used in connection with drying materials that can be mixed or tumbled in the drying process. The company is also about to issue Bulletin No. 104 on a line of vacuum drying and impregnating apparatus units for the impregnation of armatures, field magnets and transformer coils, power and telephone cables, insulator pins and electrical work, etc.; Bulletin No. 105, on a line of autoclaves; Bulletin No. 106, on vacuum pans; Bulletin No. 107, on high-efficiency dry vacuum pumps, and Bulletin No. 108, on jet and surface condensers.

New England

TURNER, ME.—The Turner Light & Power Company contemplates improvements to its plant, including the construction of a new cement bulkhead, a new penstock and probably two new water wheels.

HAVERHILL, MASS.—The Board of Trade has decided to install an ornamental lighting system on the promenade on the beach front.

LOWELL, MASS.—The Lowell Electric Light Corporation has started work on the erection of an addition to its boiler house in Perry Street, to cost about $5,200.

LYNN, MASS.—The City Council has granted the Eastern Massachusetts Electric Company a 25-year franchise to erect transmission lines on city of Lynn property in Lynnfield.

NORTHAMPTON, MASS.—The Northampton Electric Lighting Company has awarded contract to the J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y., for the engineering and construction work involved in the installation of a substation at Northampton of 5000 kva. capacity, 13,000 volts to 2300 volts, alternating current, and the erection of a double circuit heavy copper transmission line between Northampton and East Hampton.

PLYMOUTH, MASS.—Plans are being prepared and preliminary work has been started for changes to be made in the power plant of the Plymouth Cordage Company, which may eventually develop into a large central power plant for all of the mills. At present each mill has its own power plant. The plans provide for the installation of one 2000-kw. and one 500-kw. steam turbine.

BRIDGEPORT, CONN.—A permit has been granted for the foundation work on power house (89 ft. by 80 ft.) at the plant of the American Graphophone Company on Summerfield Avenue.

WATERBURY, CONN. — Improvements involving an expenditure of $100,000 to the Waterbury plant of the Housatonic Power Company is under consideration. The proposed work includes the installation of a 10,000-kw. generator, six 500-hp. boilers, a coal reclaiming plant, coal conveyor, two boiler feed pumps, one 2000-hp. economizer, one 1000-hp. economizer and two condensers, etc. Contract has been placed for the generator.

Middle Atlantic

AMSTERDAM, N. Y.—The contract for construction of mill for the Chalmers Knitting Company has been awarded to the Turner Construction Company, 11 Broadway, New York; also for power house and dye house. C. R. Makepeace & Company of Providence, R. I., are engineers.

BROOKLYN, N. Y.—Bids will be received by R. A. C. Smith, commissioner of docks, Pier "A," foot of Battery Place, North River, New York, until Aug. 15, under contract No. 1483, for furnishing and installing six portable electric winches with appurtenances on the pier near the foot of Thirty-fifth Street, in the borough of Brooklyn. Blank forms and further information may be obtained at the above office.

CHATHAM, N. Y.—Many extensions of the electric transmission lines of the Chatham Electric Light, Heat & Power Company in Columbia County have been approved by the Public Service Commission, subject to the local franchises from the towns. The extensions will be in the town of Chatham lying south of Kinderhook Creek and school district 11 of the town of Chatham as at present constituted; the town of Austerlitz; that part of Claverack between Mellenville and Philmont and the town boundary line near Tipple's Crossing; the town of Hillsdale; school district No. 1 of the town of Taghkanic and joint school district No. 4 of the town of Taghkanic and Hillsdale, and all of the town of Copake.

HAMBURG, N. Y.—The Depew & Lancaster Light, Power & Conduit Company of Lancaster has acquired the local electric-light plant and, it is understood, will rebuild the entire system.

NEW YORK, N. Y.—Bids will be received at the office of the depot quartermaster, New York, N. Y., until Aug. 17 under schedule 897 for furnishing dry batteries, etc. For further information address A. L. Smith, colonel, quartermaster corps, U. S. army, depot quartermaster.

NIAGARA FALLS, N. Y.—The International Acheson Graphite Company of Niagara Falls has purchased 20 acres of land along the Niagara River, 1 mile north of the Buffalo City line, where a large branch plant will be established. The cost of the buildings is $500,000. The company has closed a contract with the Buffalo General Electric Company for a block of 9000 hp. of electrical energy to be generated at its new plant now under construction, near the site of the proposed site of the new graphite plant.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NORTHPORT, N. Y.—The Public Service Commission has granted the Long Island Lighting Company permission to issue $80,000 in capital stock and $92,000 in bonds. Of the proceeds $104,000 will be used for improvements at the Northport station, $10,000 for improvements and extensions in Northport district and $10,000 for similar extensions in the Sayville district.

NORTH COLLINS, N. Y.—The Public Service Commission has approved the franchise and has granted a certificate of convenience to the Niagara Falls & Lake Erie Power Company of Fredonia for extensions of its electric transmission lines in the town and village of North Collins.

OSWEGO, N. Y.—The Water Service Commission, which has charge of the development of the power at Dam No. 6 in the Oswego River, will soon advertise for bids for construction of the proposed plant, to be erected at the west end of the dam. John A. Bensel, 111 Broadway, New York, N. Y., is consulting engineer.

PALMYRA, N. Y.—The power house at Lock 29, which fell into the race July 4, it is expected, will be raised and placed on a new foundation some distance west from the present location. A temporary power house has been erected and machinery installed.

WATERTOWN, N. Y.—The Northern New York Utilities Company of Watertown has awarded a contract to Burn Brothers & Haley for the construction of a concrete dam on the Beaver River on the site of the old wooden dam of the former Carthage Electric Light Company, to cost $50,000.

WATERTOWN, N. Y.—The New York Air Brake Company has awarded the contract for the construction of a new power plant (to develop 2000 hp.) at the east plant to the Construction Company of New York. Plans and specifications are being prepared by the Green Engineering Company of Springfield, Mass.

WELLSVILLE, N. Y.—The Moore Steam Turbine Corporation of Wellsville, recently organized to manufacture single and multi-stage steam turbines, is planning to build a reinforced concrete factory, power house and testing plant, for which contracts will be let at once.

BEAVERDALE, PA.—The Logan Coal Company is contemplating the construction of a power plant. A. Applegard is general superintendent.

BOWMANSVILLE, PA.—The Bowmansville Electric Company, recently organized, has been granted permission to install an electric plant here. S. R. Rothermel of Reading is interested in the company.

CLIFTON HEIGHTS, PA.—Stewart & Fleet, who operate the Caledonia Woolen Mills, are contemplating the construction of a new power plant, consisting of a boiler house and engine room. Frank E. Hahn is architect.

EDDYSTONE, PA.—The installation of an electric street-lighting system to replace the gas lamps now in use is under consideration by the City Council.

FORT WASHINGTON, PA.—Plans are being considered for extensions to the street-lighting system here.

JOHNSTOWN, PA.—Arrangements have been made whereby the Dale Light & Power Company of Johnstown will dispose of $300,000 in bonds to provide funds to extend its transmission lines into the city of Johnstown and to furnish electrical service throughout the entire city under the franchise granted by the City Council.

MOUNT WOLF, PA.—The Public Service Commission has approved the plans of the Edison Light & Power Company of York for the installation of an electric-lighting system in Mount Wolf.

PHILADELPHIA, PA.—The Pennsylvania Railroad Company is contemplating the construction of a new power plant at its freight yard on Reed Street. W. H. Cookman is architect.

PHILADELPHIA, PA.—An ordinance has been signed by Mayor Smith appropriating $2,300,000 for improvements to Byberry Farms to be used as follows: $500,000 for erecting institution for feeble-minded; $300,000 for erecting building for care of tubercular patients and $1,500,000 toward erecting buildings, equipment and power plant, railroad sidings and other work in connection with necessary buildings for male department of Philadelphia Hospital for Insane.

QUAKERTOWN, PA.—The Quakertown & Delaware River Railroad, running from Quakertown to Riegelsville, a distance of 15 miles, was sold at auction to John M. Buckland of Allentown. The railroad, which has been operated by gasoline, it is understood, will be equipped for electrical operation.

SHARON, PA.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in Sharon.

SHARON, PA.—The Standard Car Construction Company, which is erecting a large plant at Masury, has entered into a contract with the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, for electricity to operate its shops. The entire plant will be equipped for electrical operation. The contract calls for more than 2000 hp.

SOMERSET, PA.—Plans are reported to be under way for the construction of a large hydroelectric plant on the Stonycreek River, in Somerset County, between Shanksville and Mostoller. The dams in which water will be impounded will be built in the narrow gorges in the 5-mile valley below Shanksville. The main dam, which will be located just above Mostoller, will be built at a point where the valley is only 450 ft. wide and at the level of the stream, with a breast 75 ft. high and between 750 and 800 ft. in length at the top. Another dam will be built about 1¼ miles up the stream. The plans provide for several auxiliary reservoirs. Lewis C. Lambert of Somerset is interested in the project.

SPRUCE GROVE, PA.—The property of the Octoraro Water Company, including saw and feed mill, has been purchased by James Ferguson of Oxford. Extensive improvements will be made to the plant, including the installation of an electric-light plant.

WAYNESBORO, PA.—Right of way for an electric transmission line from Waynesboro to Mont Alto is now being secured by Dr. W. H. Brosius of Mont Alto and E. O. Blair of Waynesboro.

CALDWELL, N. J.—Bids will be received by the committee on public buildings of the Board of Chosen Freeholders of the County of Essex, Court House, Newark, until Aug. 16 for furnishing material for the installation and completion of the electrical work in the women's wing of the Essex County Penitentiary. Copies of plans and specifications may be obtained on application to Joseph B. Allen, architect, 109 Sanford Avenue, Irvington, N. J., upon deposit of $10. August L. Lacombe is chairman of committee.

CEDAR GROVE, N. J.—The installation of a street-lighting system on the important thoroughfares in Cedar Grove is under consideration by the Township Committee.

NEW BRUNSWICK, N. J.—Plans have been prepared by Ballinger & Perrot, architects, Seventeenth and Arch Streets, Philadelphia, Pa., for a boiler house for the Ring-Walt Linoleum Company.

PRINCETON, N. J.—The Rockefeller Institute for experimenting on animals with a view of discovering causes for human ailments, which is being erected near Princeton, will be equipped with a private electric-light and power plant. Motors for pumping water, etc., will also be installed.

WILMINGTON, DEL.—Bids will be received by the Board of Water Commissioners, at the office of the Water Department, Wilmington, Del., until Sept. 6 for furnishing and erecting two 9,000,000-gal. and one 12,000,000-gal. steam turbine driven centrifugal pumps. Copies of plans and specifications may be obtained at the office of Edgar M. Hoopes, Jr., chief engineer, Wilmington, and at the office of George W. Fuller, 170 Broadway, N. Y., consulting engineer, upon deposit of $5.

CHARLESTON, W. VA.—The Public Service Commission has granted the Northern Virginia Power Company of Charleston permission to increase the height of its dam across the Shenandoah River at Keys Ferry by 9.3 ft., making the total height 21.3 ft.

SALEM, VA.—An ordinance providing for granting a franchise for the conduct of an electric power business in the town of Salem and inviting bids thereto has been adopted by the Town Council. Bids will be received until Aug. 18.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 1 for repairs to elevators,

Treasury Building, Washington, D. C. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 24 for ventilating apparatus in room No. 410, supervising architect's office, Treasury Department, Washington, D. C. For details see proposal columns.

WASHINGTON, D. C.—The Mount Vernon Seminary has awarded contract for construction of school buildings to the Boyle-Robertson Construction Company, 1516 H Street, Washington. The main building will be 216 ft. by 236 ft., two stories, attic and basement; separate building for power plant, laundry and garage. The cost is estimated at $300,000. Wesley S. Bessell, 56 West Forty-fifth Street, New York, N. Y., is architect.

North Central

DETROIT, MICH.—Contracts have been awarded for a power plant in connection with the plant of the Schlieder Manufacturing Company, East Grand Boulevard and Oakland Avenues.

LANSING, MICH.—The Michigan State Fair Association is planning to install an electric-lighting system. G. W. Dickinson of Pontiac is general manager of the association.

MARQUETTE, MICH. — Improvements are contemplated by the Marquette County Gas & Electric Company during the present year, involving an expenditure of about $63,000, and will include the installation of a 1000-kva. turbo-generator and a 500-hp. boiler (already purchased). Other equipment will be purchased later in the year.

NEGAUNEE, MICH.—The Board of Public Works has awarded contract for the erection of an addition to the boiler house at the municipal electric-light plant to Louis Erickson & Son of Ishpeming, Mich. Three Sterling boilers, having a rating of 125 to 150 hp. each, will be installed.

ONAWAY, MICH.—The Onaway Electric Light & Power Company contemplates the construction of a new dam on Black River.

STURGIS, MICH.—Bids will be received by J. H. Whitmer, secretary of Board of Education, until Aug. 22, for construction of high school building. Separate bids to be submitted for plumbing, heating and ventilating and electrical work. Robinson & Campau, Houseman Building, Grand Rapids, Mich., are architects.

DELAWARE, OHIO.—The property of the Delaware Electric Light, Heat & Power Company has been purchased by the National Utilities Company of Boston, Mass.

EAST LIVERPOOL, OHIO.—The City Council has granted the East Liverpool Traction & Light Company permission to construct a cable line from First Street and back of Chester to and within Fairview to supply electrical service in that vicinity. The company also plans to extend the cable line to Weirton via Fairview and New Cumberland.

FREMONT, OHIO.—One of the largest generators in the power station of the Ohio State Power Company near Fremont was burned out on July 27, causing a loss of about $15,000.

WEST PARK, OHIO.—Bids will be received by Fred Feuchter, village clerk, until Aug. 21, for erecting an engine house on Lorain Avenue. Separate bids to be submitted on general contract, electrical work, heating, etc.

RUSSELLVILLE, KY.—The City Council has granted the Tennessee & Kentucky Interburban Railroad Company a franchise to construct an interburban railroad into Russellville. The company proposes to build an electric railway from Nashville to Russellville. Paul D. Denton of Nashville, is secretary.

CROTHERSVILLE, IND.—The franchise recently sold to Frank Brady, a local banker, has been approved by the Public Service Commission. The Crothersville Water & Light Company has been denied the right to operate a lighting plant.

EAST GARY, IND.—The Calumet Electric Company, which operates properties in Lake, Porter and Laporte Counties, Ind., and Cook County, Ill., has applied to the Public Service Commission of Indiana for authority to issue $75,000 in bonds, the proceeds to be used chiefly to erect an extension of a high-tension transmission line from the main trunk line of the company in East Gary, Ind., through or near Hobart, Ind., thence on to Hammond, to cost about $55,000.

MUNCIE, IND.—Excavation has been started on the foundation for the new 10,000-kw. turbine to be installed at the plant of the Muncie Electric Light Company. Work on changing the steam plant into a substation at Montpelier is now under way. This substation will be connected to the general system of the Muncie Electric Light Company at Hartford City. The transmission line is now under construction. W. O. Haymond is superintendent.

PAOLI, IND.—Improvements are contemplated to the municipal electric-light plant, including the erection of some new poles and new wire and a few lightning arresters. A. J. Rhodes is town clerk.

PENDLETON, IND.—The Board of Electric Light Commissioners is contemplating erecting 5 miles of transmission lines into the country this fall. Alva Apple is superintendent.

PLYMOUTH, IND.—The Plymouth Electric Light & Power Company is contemplating the erection of a 13,200-volt electric transmission line to Hamlet, a distance of about 6 miles, this fall.

WARREN, IND.—The Town Board has entered into a contract with the M. & B. Traction Company for energy to operate the municipal electric system and for pumping the town water supply.

ALTON, ILL.—The boiler room of the old power house at Sixth and Piasa Streets of the Alton Gas Company was recently decently destroyed by fire, causing a loss of about $10,000. It is understood that it will be rebuilt as soon as possible.

GILLHAM, ILL.—The installation of an electric-light plant in Gillham is under consideration. William A. Burr is interested.

JOLIET, ILL.—The Board of Trustees of the Sanitary District of Chicago has decided to submit a bid for the power rights of the dam at Joliet when the lease of the Commonwealth Edison Company of Chicago expires. If successful in securing the lease the Sanitary District will build a power plant at a cost of $200,000 capable of maintaining 5000 additional street lamps in Chicago.

NEW BADEN, ILL.—Bids will be received until Aug. 14 by the village clerk, New Baden, for furnishing material and constructing a reinforced concrete chimney, 100 ft. high and 4 ft. in diameter, for the municipal electric-light plant.

SPRING VALLEY, ILL.—The Spring Valley Utilities Company contemplates extension of the 33,000-volt transmission line and the purchase of two 200-kva., 33,000-volt transformers. R. W. Brown is secretary.

WOODSTOCK, ILL.—The light and water commission is contemplating the installation of a 300-kva. alternator in the municipal electric-light plant. Ernest Fues is auditor.

CLINTON, WIS.—The installation of an ornamental lighting system in Clinton is under consideration.

DARLINGTON, WIS.—The electric plant of the Darlington Electric Company was recently destroyed by fire.

IXONIA, WIS.—The Ixonia-Ashippun Electric Company, recently organized, is planning to install an electric plant to supply electricity in the villages of Ixonia and Ashippun. Edmund C. Rosenburg and Philip Grossman are interested in the company.

OCONOMOWOC, WIS.—The City Council has decided to submit to the voters at the fall election the proposal of the Milwaukee Railway & Light Company to supply electricity to the city of Oconomowoc.

PALMYRA, WIS.—Application has been made to the Council by the Wisconsin Gas & Electric Company of Kenosha for a franchise to supply electricity for lamps and motors in Palmyra.

DOVER, MINN.—The Village Council has granted Herbert Merrifield a franchise to extend electric transmission lines through Dover.

GLENCOE, MINN.—The installation of an ornamental street-lighting system in Glencoe is under consideration.

MADELIA, MINN.—Bids will be received by the Village Council until Aug. 21 for the construction of a city hall and fire station. Separate bids to be submitted on general contract, heating, plumbing and electric wiring. Plans are on file in the office of F. H. Hillesheim, city clerk, Madelia, and George Pass & Son, architects, Mankato, Minn.

STILLWATER, MINN.—The Northern States Power Company, which controls the Consumers Power Company, has asked the appointment of a commission to condemn certain lands, to enable the company to erect electric transmission lines from the Mackey sawmill, Oak Park, westward through Washington County.

BELLEVUE, IOWA—The city of Bellevue, it is reported, has sold an issue of $14,000 electric light bonds to George M. Betchel & Company of Davenport.

CAIRO, IOWA—The Municipal Electric Light and Water Department is now installing an ornamental street-lighting system, consisting of 25 ornamental standards, carrying five lamp clusters, four 60-watt and one 100-watt lamps, to be maintained by underground wires (three wire system). U. A. Clifford is superintendent.

CHESTER, IOWA.—Bids will be received by E. D. McWilliams, secretary, Chester Improvement School District, Chester, until Sept. 14, for heating, ventilating and electric wiring and equipment for school building. Bids for construction of building will be received until Aug. 31. Plans and specifications may be obtained on application to F. H. Mosse & Company, architects, Rochester, Minn., on deposit of $8.

DANBURY, IOWA.—A special election will be held on Aug. 14 to submit to the voters the proposal to sell the municipal electric-light plant. If the proposal is carried, bids will soon be asked for.

DIAGONAL, IOWA—The city of Diagonal has granted David G. Fisher & Company of Davenport a franchise to furnish electricity in Diagonal and vicinity.

LENOX, IOWA—The Lenox Electric Company is contemplating making some changes to its plant, but as yet nothing definite has been decided upon. F. A. Thompson is manager.

MANCHESTER, IOWA—The Hoag electric light and water power plant in Manchester has been purchased by the Iowa Electric Company of Marengo, which will be consolidated with the steam plant recently acquired by the company here. Extensive improvements are contemplated by the Iowa company in Manchester.

ONEIDA, IOWA.—The Iowa Railway & Light Company of Cedar Rapids has been granted a franchise to extend its transmission lines into Oneida and to furnish electrical service here.

SIOUX CITY, IOWA.—The contract for electric wiring for court house at Sioux City has been awarded to the Electrical Construction Company, 174 East Sixth Street, St. Paul, Minn., at $14,600.

SPENCER, IOWA—The municipal power plant is to be completely rebuilt, a new generating unit and boilers added to the equipment and a coal handling device is to be installed. C. A. Kutcher is manager.

MARYVILLE MO.—The Maryville (Mo.) Electric Light & Power Company has applied for a franchise to furnish electrical service in Ravenwood.

PARNELL, MO.—Application has been made to the town of Parnell by the Maryville (Mo.) Electric Light & Power Company for a franchise to supply electricity here.

ESMOND, N. D.—The installation of an electric-light system in Esmond is under consideration. Messrs. Page & Holbrook of Rugby are interested in the project.

CLARK, S. D.—An election may soon be called to submit the proposal to issue bonds for the installation of an electric-lighting system to the voters.

BURKETT, NEB.—All bids submitted for additions to power house and ice making machinery for the Soldiers and Sailors Home were rejected by the Commissioners of State Institutions. Definite action will soon be taken on underground heating system and boiler specialties. Leo Matthews of Lincoln is secretary of commission; the Martz Engineering Company, Orpheum Theatre Building, Lincoln, has charge of engineering work.

GENEVA, NEB.—The local electric-light plant, owned by G. F. Shinkle, has been purchased by the Continental Gas & Electric Corporation of Cleveland, Ohio. Electricity to operate the local system, it is understood, will be secured from the hydroelectric plant at Boelus, near Grand Island, as soon as transmission lines can be erected. F. J. Gunther of York has been appointed manager.

HAVELOCK, NEB.—Bids will be received by the Board of Education of Havelock until Aug. 31 (readvertisement) for the construction of a high school building, to cost about $50,000. Separate bids to be submitted on heating, plumbing and electric wiring. W. F. Gernandt, Keeline Building, Omaha, Neb., is architect.

OMAHA, NEB.—The Omaha & Lincoln Railway & Light Company has purchased the electric transmission line extending from Louisville, Neb., to Plattsmouth, Neb., where a line crosses the Missouri River, joining with the Mills County (Iowa) Company, enabling the Omaha company to transmit energy to Glenwood, Iowa, via Plattsmouth.

AUGUSTA, KAN.—An election will soon be held to submit to the voters the proposal

to issue $10,000 in bonds for extensions to the electric-lighting system.

FREMONT, KAN.—The city of Fremont is planning to install a distribution system and erect a transmission line to Lindsborg, where energy will be secured to operate the local system.

HIGHLAND, KAN.—Plans are being considered by W. V. Warner, owner of the local electric-light plant, to purchase energy from the plant in Hiawatha to operate the local system and close down the plant here. The Highland plant is unable to meet the demands for service.

IUKA, KAN.—The City Council has adopted an ordinance authorizing an issue of $3,000 in bonds for the installation of an electric-lighting system in Iuka. Energy will probably be obtained from the plant in Pratt.

PALCO, KAN.—The town of Palco has engaged George P. Taylor of Stockton, Kan., engineer, to prepare plans for the proposed municipal electric-light plant and water-works system. An election will soon be called to vote on a bond issue for the above work.

STERLING, KAN.—Bonds to the amount of $45,000 have been voted to establish a municipal electric-light plant in Sterling. The purchase of the local plant is under consideration.

Southern States

CHARLOTTE, N. C.—The Southern Power Company, it is reported, will repair hydroelectric plants damaged by the flood on basis of the latest high waters of Catawba River. It may rebuild power houses and elevate transmission towers.

NORTH WILKESBORO, N. C.—The Moravian Falls Milling & Power Company is rebuilding its hydroelectric plant, recently washed away by the floods. The company is considering enlarging the plant. B. O. Austin of Charlotte, N. C., is consulting engineer.

VARINA, N. C.—The Dixie Water & Light Company of Varina, it is reported, would like to receive catalogs and prices on family electric-light plants, water-works, acetylene gas lighting equipment, towers and overhead tanks, pneumatic tank pumps, small dynamos, storage batteries, wire, electrical fixtures, etc.

HICKORY GROVE, S. C.—The installation of an electric-light plant in Hickory Grove is under consideration. J. S. and S. C. Wilkerson are reported interested in the project.

COMMERCE, GA.—The City Council has called an election to be held Aug. 15 to vote on the proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant.

JACKSONVILLE, FLA.—The public works committee of the City Council has decided on the opening up of Eighth Street from Evergreen Avenue to Talleyrand Avenue, the extension of the Florida Avenue car line to Eighth Street and then out Eighth Street to Talleyrand Avenue and thence to the municipal electric-light plant.

SARASOTA, FLA.—Plans are being considered by the West Coast Electric Railway Company to construct an electric railway south from Tampa, via Bradentown and Sarasota, thence to the east coast.

LEBANON, TENN.—At an election to be held Aug. 24 in the county the proposal to issue $150,000 in bonds for the construction of an electric railway will be submitted to the voters. For further information address the county clerk.

TRIMBLE, TENN.—Bonds to the amount of $5,000 have been authorized for the construction of a municipal lighting plant.

ASHLAND, ALA.—The Southern Star Graphite Company is planning to build a 400-ton mill for recovery of graphite. The equipment will include crusher, conveyors, dryers, generators, etc. George G. Montz, 27 Stoecker Avenue, Louisville, Ky., is interested.

TCHULA, MISS.—Bonds to the amount of $4,600 have been voted for the installation of an electric-lighting system.

LITTLE ROCK, ARK.—Estimates are being received by Frank M. Blaisdell, Bankers' Trust Building, Little Rock, for the installation of a power plant at Little Rock College.

KENNER, LA.—Steps have been taken by the property holders of Jefferson Parish to secure improvements in this district, including the construction of an electric-light plant, extension of water mains from the New Orleans water purification plant. A mass meeting will be held Aug. 12 at Kenner for the purpose of organizing the East Side Jefferson Parish Improvement Association to take charge of the proposed improvements. I. B. Rennyson, 401 Carondelet Street, New Orleans, is interested.

BLACKWELL, OKLA.—The proposal to issue $45,000 in bonds for further extensions and improvements to the municipal electric-lighting system and water works will be submitted to the voters.

WETUMKA, OKLA.—Improvements to the municipal electric-light plant, to cost about $4,000, are under consideration; also extensions to the water-works system to cost about $16,000.

WOODWARD, OKLA.—An election will soon be called to submit to the voters the proposal to issue $12,500 in bonds for water-works improvements and $2,500 for electrical improvements.

AUSTIN, TEX.—The contract for improvements to the electric power plant at the State Capitol has been awarded to the Trinity Construction Company of Dallas at $4,230.

AUSTIN, TEX.—The local plant of the Southwestern Telephone Company was recently destroyed by fire, causing a loss of about $100,000. The plant, it is understood, will be rebuilt.

HOUSTON, TEX.—Bids will be received until Aug. 25 by E. B. Bonney, city secretary, for furnishing material, machinery, electric motors, etc., for the installation of three apron conveyors of the Reno type at municipal wharf No. 4.

MIAMI, TEX.—The City Council has engaged Henry E. Elrod, engineer, Southwestern Life Building, Dallas, Tex., to prepare plans and supervise the construction of the proposed electric-light plant and water-works system, to cost about $25,000.

Pacific States

MENDON, UTAH—A franchise has been granted to H. J. McKay of Weston, Idaho, and T. J. Yates of Salt Lake City, to install and operate an electric-light plant in Mendon.

EVERETT, WASH.—Robert Howe, consulting engineer, American Bank Building, Seattle, engaged by the City Council to investigate the power possibilities of the Sultan River, where a proposed municipal electric plant may be constructed, states that 72,500 electrical horsepower can be delivered in Everett for a 12-hr. period or 36,250 hp. for a continuous period. The cost of developing the full amount is estimated at $6,127,000. The city, according to Hans Mumm, Jr., city engineer, will not need all of this power for many years and plans to construct a plant, one unit at a time.

HOQUIAM, WASH.—The City Council, it is reported, will soon call for bids for street-lighting. A contract is now held with the Grays Harbor Railway & Light Company of Aberdeen.

SEATTLE, WASH.—According to J. D. Ross, superintendent of the municipal electric-light plant, approximately $435,000 will be expended for betterments and extensions by the Municipal Light Department during 1917, which will include $10,000 for overhead alterations in plant, $70,000 for proposed underground improvements and extensions; also extension of overhead lines, costing $275,000, will be completed in 1917.

MYRTLE CREEK, ORE.—A special election will be held Aug. 26 to submit to the voters the proposal to issue $27,000 in bonds for the installation of a municipal electric-lighting system. Plans have been approved by the Council. M. B. Germond is engineer.

PORTER, ORE.—The Buehner Lumber Company of North Bend, it is reported, is planning to equip its mill at Porter for electrical operation. The Buehner company is negotiating with the Oregon Power Company in regard to the installation.

PORTLAND, ORE.—Bids will be received by the city purchasing agent, Portland, until Sept. 1, for a multi-stage turbine pump, directly connected to a 200-hp. electric motor. Specifications are on file at Room 208, City Hall, Portland.

LOS ANGELES, CAL.—Bids will be received by the Board of County Supervisors until Aug. 21 for furnishing and installing electric passenger elevators, two electric freight elevators and two electric dumbwaiters in the service building at the County Hospital. A. M. McPherson is secretary.

LOS ANGELES, CAL.—A permit has been issued for the erection of the municipal substation at 1636 St. John Street, to cost about $50,000. This will be the main substation for Owens River power project. Energy will be transmitted to this station at 100,000 volts and will be distributed through local station on 30,000 volt lines. Two local stations are now being built, one in the Garvanza district and one in Hollywood.

SAN DIEGO, CAL.—The City Council has authorized F. M. Lockwood, manager of city operating department, to prepare plans for pumping station to be located on Tia Juana River, to cost about $100,000.

SAN FRANCISCO, CAL.—The erection of a high-tension transmission line from the Early Intake temporary power plant to Hetchy Hetchy dam site, 12 miles long, is under consideration. Surveys will soon be made for this line and also for the transmission line in Moccasin Creek and Lake Eleanor. About $120,000 will be expended for construction of the power plant and transmission line this year.

VENTURA, CAL.—The Ventura Light & Power Company contemplates the construction of a reservoir east of Ventura, to cost about $15,000.

VISALIA, CAL.—The Pacific Electric Company has applied to the State Railroad Commission for permission to construct and extend the Visalia Electric Railway Company's railway to different points in Tulare County. The work will consist of approximately 46 miles of trackage.

OATMAN, ARIZ.—Plans are under consideration for the construction of a large hydroelectric plant on Burro Creek and the erection of an extensive system of transmission lines for the purpose of furnishing energy for the mines in this part of Arizona.

TUCSON, ARIZ.—Application has been made to the Department of the Interior by John W. Dailey and associates for permission to build a dam for the storage of water in Sabino Canyon and for the construction of a hydroelectric power plant. The plans also include the erection of a system of transmission lines to Tucson and other points in this section; also the piping of water from the proposed reservoir to this city.

CANON CITY, COL.—The Arkansas Valley Railway, Light & Power Company of Pueblo is building a new 7500-kw. plant in Canon City. Orders have been placed for all material. W. F. Raber is vice-president and general manager.

LOVELAND, COL.—The contract for construction of 827 ft. of tunnel leading from the present dam to the city water works of Loveland has been awarded to F. C. Dieher of Denver. This tunnel is part of the preliminary construction necessary for building a municipal electric-light system. Contracts will soon be let for construction of power house and for equipment, including two water turbines. The total cost of the system is estimated at $120,000. E. S. Bice of Longmont is city engineer of Longmont and Loveland.

SANTA FE, N. M.—Financial arrangements have been made by the Rio Grande Light, Heat & Power Company, which proposes to develop power in White Rock Canyon and furnish electricity in Albuquerque, Santa Fe and Las Vegas. Final plans have been filed with the State engineer and must be approved before the company can proceed. The initial cost of the project is estimated at $1,933,615.

Canada

PRINCE GEORGE (not a post office), B. C.—Plans are being considered for extensions to the water-works system and the installation of an electric-lighting system in Prince George, involving an expenditure of about $150,000.

ASSINIBOIA, MAN.—The rural municipality of Assiniboia is contemplating the installation of an electric-lighting system. For further information address Frank Ness, clerk, Kirkfield Park post office.

GRAND RAPIDS, MAN.—Plans, it is reported, have been prepared for the project of the Manitoba Power, Pulp & Paper Company, to be established at Grand Rapids on the Saskatchewan River, which includes a saw mill, paper factory, pulp mill and a hydroelectric power plant and transmission system. The cost of the entire system is estimated at $2,000,000.

PEMBINA, N. B.—Work has started on the construction of an electric-light plant in Pembina.

ST. JOHN, N. B.—The County Council is reported to be considering equipping a power house, laundry and lighting plant, to cost about $50,000. J. J. Kelly, Prince William Street, St. John, is secretary.

NEW GLASGOW, N. S.—The Nova Scotia Steel & Coal Company is contemplating extensions at the iron mines in Wabana, Newfoundland, which will include new hoisting equipment, boilers, pumps, compressed air plant, power lines, cables, ventilating plant, industrial railroad track, hauling cables, etc. R. E. Chambers is manager of ore mines and quarries.

LONDON, ONT.—Extensive improvements are contemplated to the London & Port Stanley Railway (municipal), involving an expenditure of about $500,000 and will include double tracking the railway to Port Stanley, a distance of 30 miles, and installing new equipment.

QUEBEC, QUE.—Specifications are being prepared and new tenders will soon be asked by the Fire Commission for a storage battery plant. Aug. Malonin is secretary.

QUEBEC, QUE.—The contract for the installation of the electric-lighting system at the Quebec Exhibition grounds has been awarded to Goulet & Belanger, electrical contractors, Quebec. The cost is estimated at $11,000.

SHIPSHAW, QUE.—Plans are being prepared by B. S. Kelsch, consulting engineer, Power Building, Montreal, for additional equipment to be installed in the Shipshaw plant of Price Brothers & Company, which will include one additional twin runner turbine of 5000 hp., together with penstock and all auxiliaries; also a new generator and accessories.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 24 for furnishing sheet steel, planished iron, steel cable, steel wire, electrical material, carbon brush plate, etc. Blanks and general information relating to this circular (No. 1069) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 29, for furnishing drill sockets and sleeves, cable clips, sheet brass, sheet copper, bearing metal, bronze, bar copper, grommets, brass tubing, lead pipe, copper wire, bell pulls, combinations and marine lamps, etc. Blanks and general information relating to this circular (No. 1070) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,192,844. METER TESTING BLOCK; H. J. Blakeslee, Hartford, Conn. App. filed Oct. 29, 1915. Compact block with special testing binding posts.

1,192,863. ELECTRIC GAS LIGHTER; W. G. Chapman, Huntington, W. Va. App. filed April 8, 1916. Has renewable electrodes.

1,192,879. THERMO CUT-OUT; Dent Ferrell, Caterville, Ill. App. filed July 29, 1915. Transformer is cut out when cooling medium becomes dangerously heated.

1,192,885. DIRECTION INDICATING APPARATUS FOR MOTOR VEHICLES; W. J. Garvey, Buffalo, N. Y. App. filed Nov. 15, 1915. Operated by push buttons on steering wheel.

1,192,906. CURRENT INTERRUPTER; C. F. Kettering, Dayton, Ohio. App. filed July 14, 1910. Single ignition spark awaits impulse.

1,192,909. SPARK GAP; G. H. Kroger, Brooklyn, N. Y. App. filed Aug. 31, 1914. Rotating disk electrodes.

1,192,911. COMPOSITE RESISTANCE; M. E. Leeds, Philadelphia, Pa. App. filed April 8, 1916. Platinum and nickel.

1,192,933. RAILWAY SIGNAL SYSTEM; A. W. Reinhardt, Bethel, Ohio. App. filed Aug. 21, 1915. Includes contact rails on track bed.

1,192,949. SUCTION SWEEPER; J. M. Spangler, Canton, Ohio. App. filed Sept. 3, 1914. Controlled by movements of operating handle.

1,192,951. AUTOMOBILE SIGNALING APPARATUS; C. R. Taggart, Chattanooga, Tenn. App. filed Feb. 9, 1915. Eliminated swinging hand pointer.

1,192,961. FLUID PRESSURE BRAKE DEVICE; M. V. Turner, Edgewood, Pa. App. filed Aug. 15, 1913. Brakes held applied until equalizing valves move to "release" position.

1,192,964. OSCILLATING CURRENT TRANSFORMER; R. A. Weagant, Brooklyn, N. Y. App. filed March 15, 1912. For wireless work.

1,192,974. AUTOMATIC FUSE CUT-OUT; C. S. Anderson, Ripon, Cal. App. filed June 29, 1915. Switch thrown when fuse in one place blows out.

1,192,975. TELEPHONE SET; C. S. Baker, Philadelphia, Pa. App. filed Sept. 6, 1912. Casing of instrument forms no part of the circuit.

1,192,993. AUTOMATIC TELEPHONE AND RESPONDING APPARATUS; F. J. Cresev, Wichita, Kan. App. filed March 11, 1915. Phonograph gives message to party calling.

1,193,012. MOTOR DRIVEN CLOCK; G. A. Goodson, New York, N. Y. App. filed Aug. 27, 1913. For large clocks with heavy hands.

1,193,018. ELECTRIC BATH; M. Howard, Fort Worth, Tex. App. filed Feb. 25, 1915. Special electrodes adapted to ordinary bath tub.

1,193,025. ATTACHING DEVICE FOR LAMP SOCKETS, ETC.; C. J. Klein, Milwaukee, Wis. App. filed Feb. 24, 1913. For locking lamp socket to the supporting pipe.

1,193,031. PORTABLE FLASH LAMP; H. E. Leininger, Chicago, Ill. App. filed July 8, 1914. Lamp carried by hinged cover which can be swung in different positions.

1,193,053. MACHINE TELEPHONE SYSTEM; L. Polinkowsky, Brussels, Belgium. App. filed March 5, 1914. Metering system.

1,193,076. ELECTRICAL CONNECTION; L. Schon, Essen-on-the-Ruhr, Germany. App. filed Feb. 20, 1912. For field windings.

1,193,081. LATCH MECHANISM FOR BULLETIN PRINTING MACHINES; K. A. A. Staahlgren, New York, N. Y. App. filed Nov. 20, 1915. Quickly and accurately seizes and holds the index wheel.

Record of Electrical Patents

Notes on United States Patents issued August 1, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,193,083. RAILWAY SIGNALING; P. H. Thomas, Upper Montclair, N. J. App. filed June 20, 1913. Special construction of relay.

1,193,095. ELECTRICAL MEASURING INSTRUMENT; H. C. West, Mount Vernon, N. Y. App. filed Sept. 4, 1914. Sliding scale instrument for measuring current.

1,193,096. ELECTRICAL MEASURING INSTRUMENT; H. C. West, Mount Vernon, N. Y. App. filed Sept. 13, 1915. For indicating "charge" or "discharge" of storage battery.

1,193,105. MOTOR DRIVE; J. J. Wood, Fort Wayne, Ind. App. filed Dec. 17, 1914. For sewing machines—pressure on treadle closes switch and releases brake.

1,193,121. ELECTRIC KNIFE HEATER; E. N. Chandler, Braintree, Mass. App. filed July 29, 1914. Has slots to receive the knife blades.

1,193,137. CALL REGISTERING SYSTEM FOR AUTOMATIC TELEPHONE SYSTEMS; C. L. Goodrum, New York, N. Y. App. filed April 24, 1915. Improved metering circuit.

1,193,138. ELECTRICAL DISPLAY MEANS; LeRoy A. Hanson, Chicago, Ill. App. filed Sept. 27, 1913. Lamps positioned so closely as to enable any figure being displayed.

1,193,160. AUTOMATIC TELEPHONE TRUNKING SYSTEM; W. E. Lamb, Chicago, Ill. App. filed Sept. 1, 1911. Improved non-numerical trunking switch.

1,193,168. ELECTRIC PROD POLE; R. E. Martin, Mason, Tex. App. filed Oct. 5, 1915. Made up of detachable sections.

1,193,169. MEASURED SERVICE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed Oct. 24, 1913. Meter operated by change in the current strength.

1,193,179. TELEPHONE CALL REGISTER AND SYSTEM; G. E. Mueller, Aurora, Ill. App. filed Nov. 19, 1906. Particularly for automatic systems (46 claims).

1,193,184. TELEPHONE TRANSMITTER; A. Plecker, Las Animas, Col. App. filed June 16, 1911. Distinctness of Blake transmitter with volume of Hunnings transmitter.

1,193,185. MACHINE FOR INTERNALLY SHAPING TELEGRAPH INSULATORS AND THE LIKE; William Potmore, Stoke-Upon-Trent, England. App. filed Feb. 11, 1916. Speed of cutting automatically reduced as cutting proceeds.

1,193,206. THERMIONIC AMPLIFIER AND RECTIFIER; H. J. Van der Bijl, New York. App. filed Sept. 1, 1915. Audion type with durable filament.

1,193,211. RAILWAY CAR; G. Webster, York, Pa. App. filed Nov. 1, 1911. Has internal combustion engine driven dynamo.

1,193,217. PRINTING TELEGRAPH SYSTEM; C. G. Ashley, Chicago, Ill. App. filed July 8, 1912. Impulse momentarily stalled through condenser reactance.

1,193,218. PRINTING TELEGRAPH RECEIVER; C. G. Ashley, Chicago, Ill. App. filed July 8, 1912. Simplified construction with greater efficiency.

1,193,239. ELECTRIC SWITCH; F. B. Cook, Chicago, Ill. App. filed Jan. 15, 1915. Plug contacts limited to engagement with spring jack contacts.

1,193,252. SELF LOCKING SIGN RECEPTACLE; E. H. Freeman, Trenton, N. J. App. filed April 8, 1914. Ratchet lock construction.

1,193,253. SWITCH BLOCK AND CASING; A. I. Fromager and J. F. Six, Montreal, Quebec, Canada. App. filed May 14, 1915. Prevents stealing current by shunting around meter.

1,193,258. SPEED CONTROL FOR TURRET LATHES AND THE LIKE; H. B. L. Gorman, Madison, Wis. App. filed May 20, 1915. Maximum efficiency of motor at all speeds.

1,193,270. MAGNETO GENERATOR; P. Van S. Kolff, Moylan, Pa. App. filed Sept. 14, 1914. Magnet poles adjustable with respect to armature.

1,193,316. ILLUMINATED ADVERTISING APPARATUS; A. E. Turnham, Adelphi, London, England. App. filed May 17, 1913. Drum rotated step-by-step.

1,193,349. DYNAMO ELECTRIC MACHINE; W. L. Bliss, Niagara Falls, N. Y. App. filed Sept. 16, 1912. Spring stop for shiftable brush mechanism.

1,193,358. ELECTRICAL TERMINAL CONNECTION; C. C. Carpenter, Niagara Falls, N. Y. App. filed Nov. 19, 1914. For storage batteries.

1,193,380. ELECTRIC SWITCH; M. Guett, Hartford, Conn. App. filed May 5, 1915. Snap construction for controlling a cooking range and a water heater.

1,193,379. AUTOMOBILE SIGNAL; E. T. Gray and A. T. Hoevet, New York, N. Y. App. filed April 14, 1914. Warning signal light and constant tail light.

1,193,404. INDUCTION HEATER; W. D. Ludwick, Tacoma, Wash. App. filed April 24, 1916. Heats water by induced magnetic hysteresis, eddy and secondary circuits.

1,193,445. ELECTRIC WATER HEATING FAUCET; E. C. Webster, East Oakland, Cal. App. filed May 17, 1915. Prevents waste of heat and drains off water remaining.

1,193,477. TROLLEY; J. C. Wells, Long Beach, Cal. App. filed Dec. 9, 1914. Arc having a vertical movement on trolley pole.

1,193,458. MEASURED SERVICE TELEPHONE SYSTEM; E. D. Fales, Chicago, Ill. App. filed Dec. 8, 1906. Improved call register.

1,193,471. SYSTEM FOR AUTOMATIC CONTROL OF RAILWAY TRAINS; B. C. Rowell, Dec'd, Chicago, Ill. App. filed Oct. 6, 1910. Especially for single track roads.

1,193,472. MECHANISM FOR OPERATING BRAKES IN SIGNAL SYSTEMS; B. C. Rowell, Dec'd, Chicago, Ill. App. filed Feb. 13, 1911. Sets train brakes when signals are at "danger."

1,193,485. CONVERTER; A. T. Kasley, Swissvale, Pa. App. filed Sept. 14, 1909. Movable terminal and sets of stationary sectors.

1,193,489. MOTOR DRIVE; A. F. Welch, Fort Wayne, Ind. App. filed Dec. 17, 1914. For sewing machines.

1,193,490. MOTOR DRIVE; J. J. Wood, Fort Wayne, Ind. App. filed July 15, 1915. Current controller and brake construction for sewing machines.

1,193,491. DISPLAY DEVICE; G. E. Baird, Dec'd, Peoria, Ill. App. filed June 23, 1913. Vanes oscillated to expose both sides.

1,193,492. TRAIN CONTROLLING APPARATUS; B. B. Breeden, Indianapolis, Ind. App. filed March 27, 1915. Automatically controlled track obstacles.